SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1937

No. 62

TEXTILE MACHINE WORKS, PETITIONER,

vs.

LOUIS HIRSCH TEXTILE MACHINES, INC.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SECOND CIRCUIT

VOL. II

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May 21, 1929. R. E. SCHLETTER 1,713,628

ATTACHMENT FOR FLAT KNITTING MACHINES

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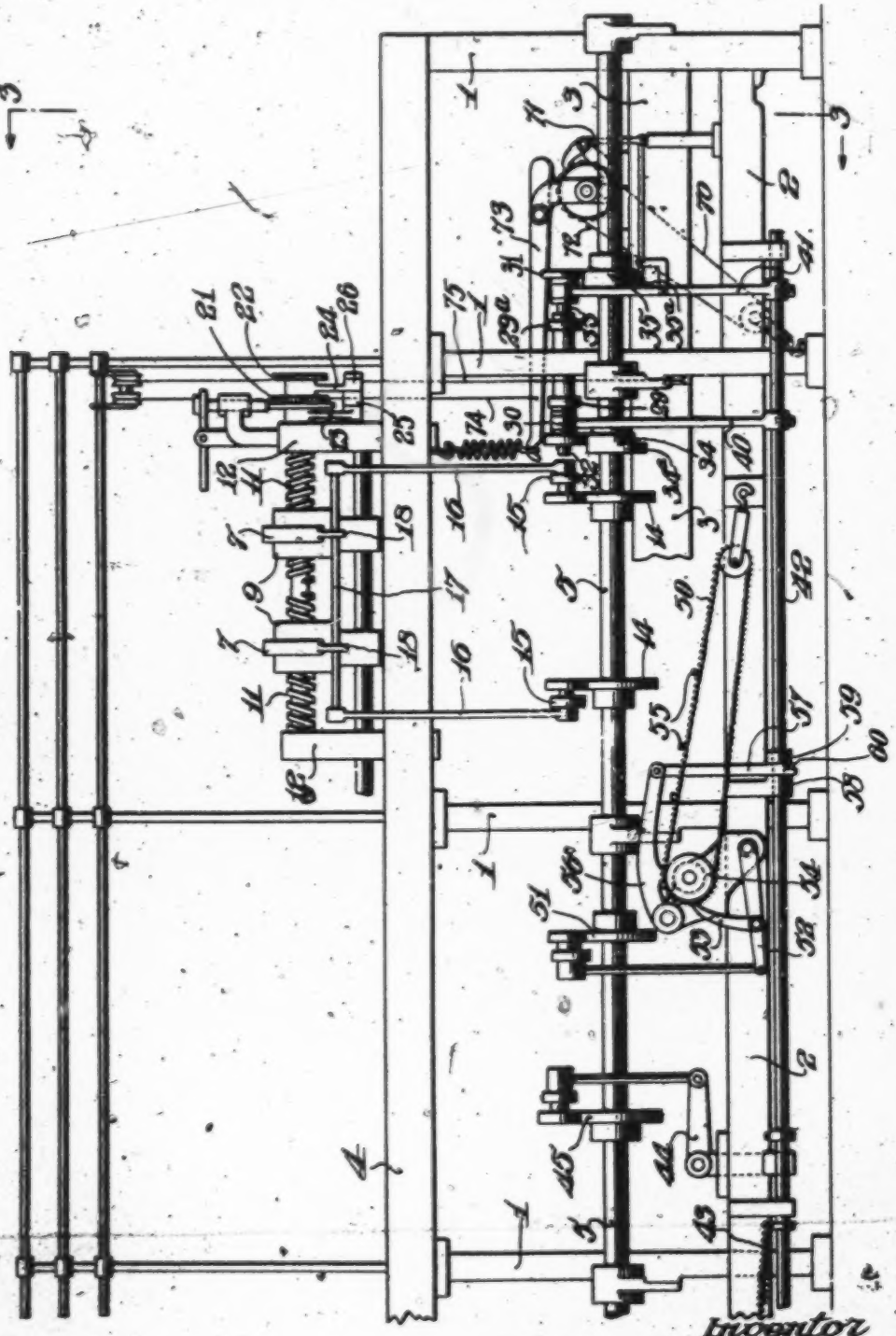

Fig. 1.

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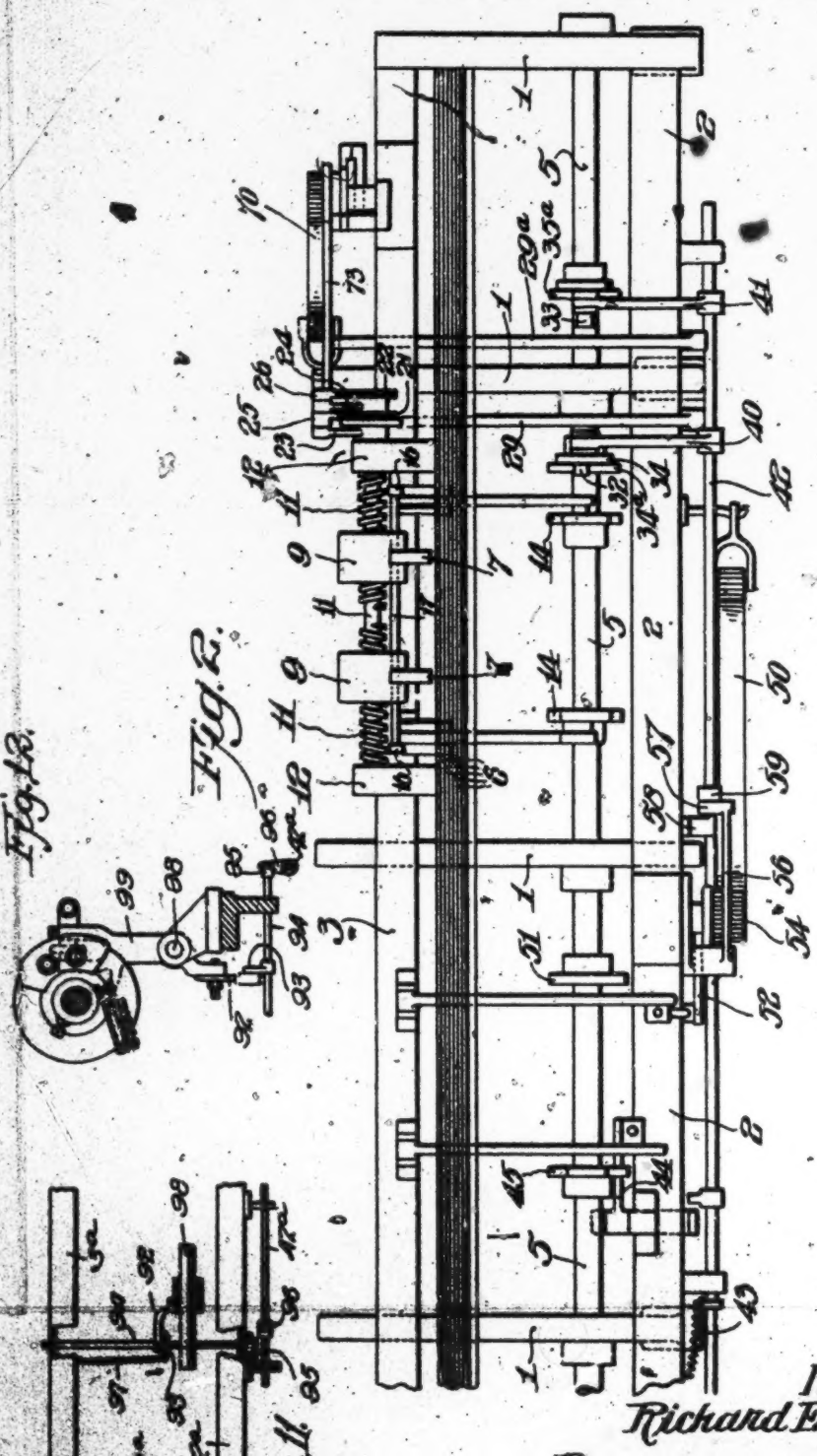

Fig. 2.

Fig. 12.

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Fig. 4.

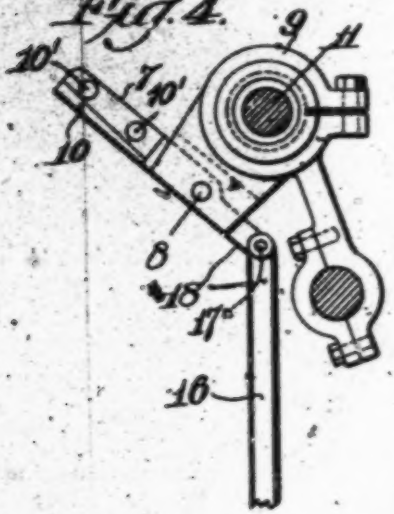


Fig. 3.

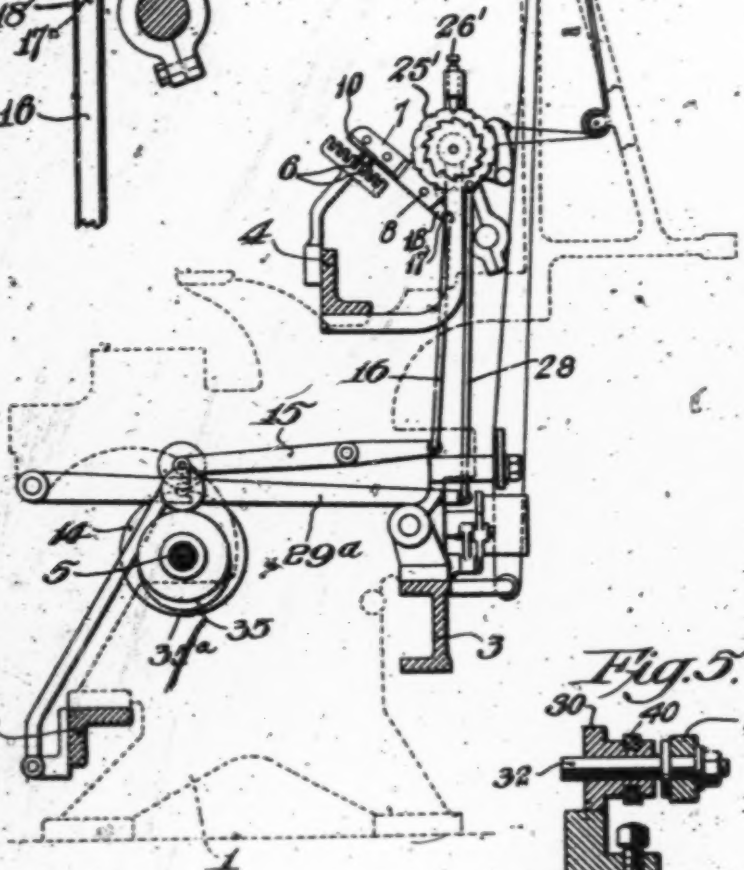
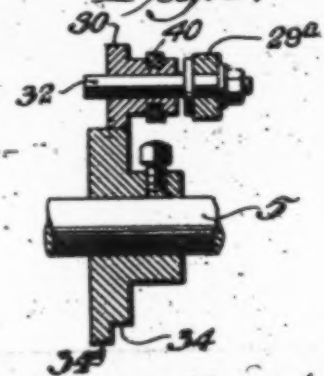


Fig. 5.



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ATTACHMENT FOR FLAT KNITTING MACHINES

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Fig. 6.

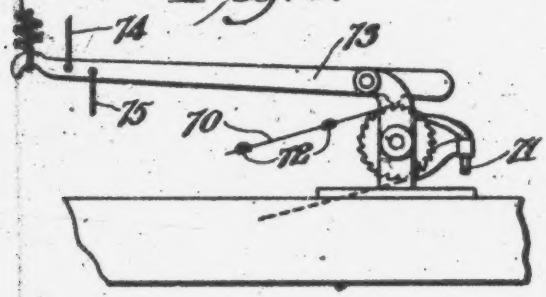


Fig. 7.

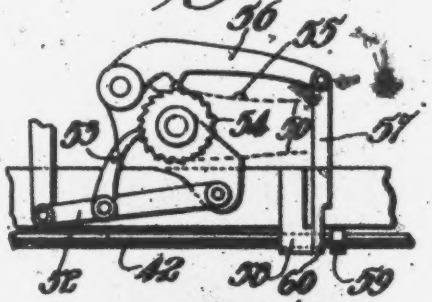


Fig. 10.

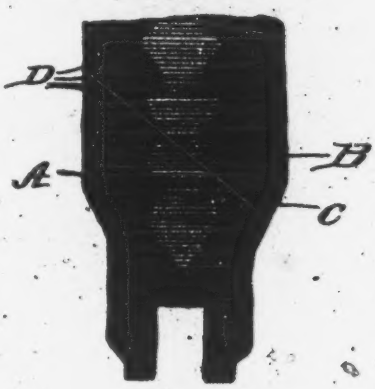


Fig. 8.

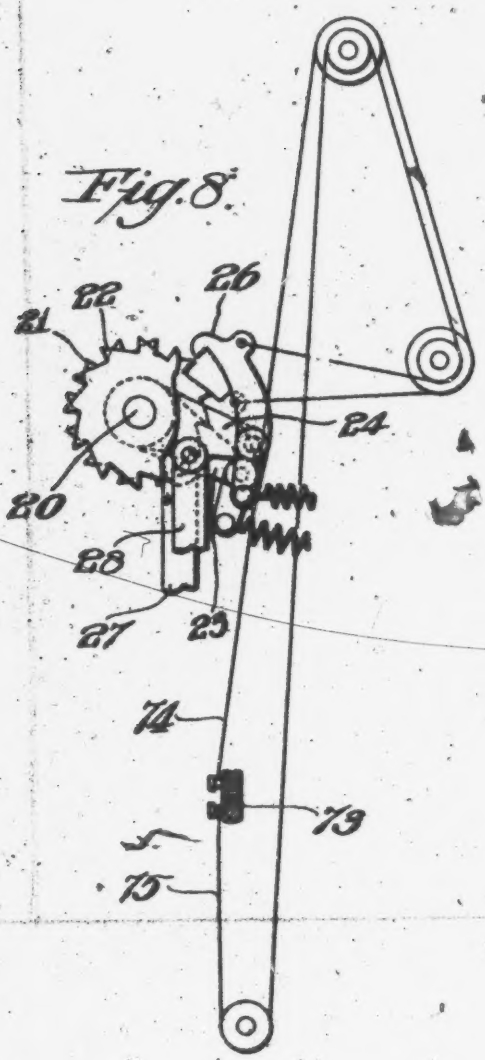
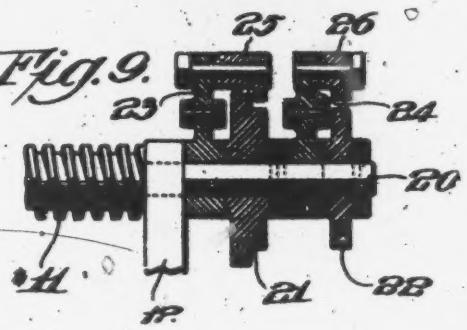


Fig. 9.



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Patented May 21, 1929. 1,713,628

UNITED STATES PATENT OFFICE.

RICHARD R. SCHLETTER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SCHLETTER & LANDER, INC., OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF DELAWARE.

ATTACHMENT FOR FLAT-KNITTING MACHINES.

Substitute for abandoned application Serial No. 569,559, filed June 19, 1922. This application filed November 5, 1925. Serial No. 66,916.

This invention, generally stated, has relation to flat knitting machines for making hosiery of full fashioned type and has more particular relation to an attachment for fashioning designs, as clocks, upon said hosiery. This application is a substitute for my abandoned application No. 569,559 filed June 19, 1922.

Commercially considered, two types of clocked hosiery are in use. In one type clocks are of open work, termed clocklace, and stockings of this type, being relatively fragile, are not suited for all occasions or every-day use and furthermore are comparatively expensive. The other type comprises hosiery in which clocks are embroidered thereon. While this type is best suited for every-day use, practice dictates, that, the action of needles laying-on the embroidery yarn serves to so weaken the stocking-web as to have a deleterious effect thereon. The embroidering operation also serves to increase manufacturing costs.

It is an object of my invention to provide an attachment for full-fashioned knitting machines whereby yarn-guides can be accurately controlled to lay a yarn over a distance less than the full length of a course being knitted, as for reinforcing or for so-called split-seam work wherein sections of fabric are connected by suture seams. For this purpose I preferably employ opposed stops with conjoint controlling means arranged to move them toward or from each other incrementally, but any equivalent means or devices may be employed which will effect the purpose of the invention.

A further object of the present invention is to provide an arrangement, connection and combination of novel mechanical movements attached to a conventional flat knitting machine for attaining the results sought by the leading object.

A further object is to provide an attachment for a flat knitting machine in which is provided a plurality of thread-carrier rods, stop-mechanism for said rods comprising a shaft including a screw having reversely-threaded portions carrying oppositely movable split-seam stops, means for moving said stops from and toward the rods to effect the split-seam interlooping of adjacent yarn-sections, means including a pattern chain and reversely-acting pawls for intermittently actuating said screw in successive courses, and separate means for selectively engaging said pawls.

A still further object is to provide an attachment for a flat knitting machine in which is provided a plurality of thread-carrier rods, stop-mechanism for said rods comprising a shaft including a screw, having reversely threaded portions carrying oppositely disposed stops, operating means for moving said stops from and toward the rods to limit variably the stroke of the yarn carrier rods, means including a pattern-chain and oppositely-acting pawls for intermittently rotating said screw in successive courses, and means including a separate pattern-chain for selectively engaging one of said pawls.

Other and further objects not at this time appearing will be hereinafter referred to.

The invention consists of the novel construction herein described and finally claimed.

The nature, characteristic features and scope of the invention will be more fully understood from the following description taken in connection with the accompanying drawings forming part hereof, and in which:

Fig. 1, is a view in front elevation of a portion of one type of full-fashioned knitting machine known as the "Cotton" machine with an attachment of the invention applied thereto, machine parts not essential to the invention being omitted.

Fig. 2, is a plan view thereof.

Fig. 3, is a sectional elevation, taken on the line 3—3 of Fig. 1, the machine frame outline being indicated in dotted lines.

Fig. 4, is an enlarged end view of the stop employed.

Fig. 5, is an enlarged cross-sectional view of the special form of cam employed for intermittently rotating the clock forming or split-seam screw that operates the stops.

Figs. 6 and 7 are fragmentary views illustrating the two pattern chain mechanisms for automatically controlling the movements of the clock forming or split-seam screw.

Fig. 8, is a view of the selective control means for engaging the reversely acting pawls;

Fig. 9, is a cross sectional showing of the pawl and ratchet mounting on the screw shaft.

Fig. 2, indicates one form of stocking fabric having yarn sections with inclined clock or split seam border line ornamentation as made by means of my attachment; and

Figures 11 and 12, details of means preventing operation of my device simultaneously with a narrowing stop.

For the purpose of illustrating my invention I have shown in the accompanying drawings two forms thereof which are at present preferred by me, since the same have been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of the instrumentalities as herein shown and described.

In practice a web of hosiery is knit upon a straight knitting machine equipped with the novel mechanism of the present invention which mechanism is capable of co-acting with respect to the web-forming needles to provide clocks or other ornamental re-inforcements which may be ornamental or useful or both, said reinforcements having zig-zag-like lines inclined to the wales and courses of the web. An example of such stocking re-inforcement, other than that shown in Fig. 10, is disclosed in letters patent granted to me under date of March 31, 1925, and numbered 1,531,349 wherein the clocks are made by a splicing yarn instead of by split-seam work. In manufacture, the stocking-web, which has selvage edges, may be knit with a main yarn in a well understood manner to that portion of the leg at which the narrowing operation takes place. At or about the time narrowing of the leg portion is commenced, additional or re-inforcing thread is presented to certain of the web-forming needles to effect formation of a clock or clocks. During formation of a clock or clocks it is to be understood that fabrication of the stocking-web, including the re-inforced heel portions, takes place in the usual and well understood manner of making full fashioned hosiery. The additional or re-inforcing thread is supplied to the web-forming needles so that zig-zag-like lines, inclined to the wales and courses of the web, are produced to effect the contour of a clock or clocks. Obviously, depending upon the contour of a clock or clocks desired, the feeding of additional thread varies. In practice I commence the formation of the clock or clocks midway of the narrowing portion of the web although obviously said formation may be started and stopped at other places and while but one clock may be formed upon a stocking web, if desired, in practice two or more are preferred, the number being immaterial.

Referring now to the attachment for making a clock or other ornamentation and referring more especially to Figs. 1 to 9 inclusive, the reference numeral 1 indicates the main frame of a flat knitting machine; 2, the front beam; 3, the back beam; 4, the center bed; and 5, the main cam shaft. Such machine may be of any well known full fashioned knitting machine type and to such my novel attachment is connected. These machines are commonly formed with a plurality of knitting sections, each of which is provided with the requisite number of yarn-guides, and the latter are mounted on longitudinally movable yarn carrier rods 6, 6, 6, 6, extending the full length of the machine and their joint movements controlled by rod-contacting stops, not shown, acting in well known manner at the ends of the machine. My invention, among other things, relates to special stops for these rods 6, 6, 6, 6, affecting the yarn-feed movements thereof, and for simplicity of showing I have indicated in the drawings only the rods themselves, it being understood that they carry thread guides and abutments such as shown in Figs. 11 and 12 and perform their usual functions as heretofore.

The special rod-stops 7, 7 (see Fig. 1) employed in my novel attachment, act in a manner similar to the action of the well known "Split-foot" stops heretofore employed in making split seam work, which stops however merely oscillated and did not travel lengthwise of the machine. In Figs. 3 and 4 of the drawings the stops are shown as having undercut portions at 10 which are desirable for split-seam work. My invention however is not limited to the use of these specific stops for this specific purpose, but they may be used for all purposes for which stops are used. With the construction illustrated in Fig. 4 it is possible to produce split-seam stitches as in the "split-foot" stocking for uniting fabric sections by the delayed partial lifting of the stops, after the arrest of the rod movements, to allow additional movement of the rods determined by the depth of the undercut portions 10 (see Fig. 4) of said stops 7, 7 this additional movement occurring after the formation of the stitches of the course and forming floats of determined length extending into the next succeeding courses of knitting, the effect being to produce ornamental border line junction seams between fabric sections of the finished fabric.

Stops such as herein illustrated are used for making spliced or plated figures on a plain fabric and for split seam work, the split seam stops being undercut as in Fig. 4 and the others not undercut as in Fig. 16. It is new to control the stops by conjoint means for moving them toward or from each other to shorten or lengthen the stroke of the same guide at both ends.

Any conventional or desirable lugs, screws or other attachments may be located on the

carrier rods for cooperating with the stops and no claim is made to such devices.

The special stop employed in my novel attachment and the mechanism for operating the same, as fully described hereinafter, provides for the introduction of this split seam anywhere in the length of the fabric, for its automatic control by pattern-chain mechanism, and for varying the spreading of said stops in successive courses to reversely incline said split-seam border lines to the wales for producing ornamental figuration of the fabric, such as clocks.

The stops 7, 7, as shown in the drawing are pivotally carried at 8, 8 in nuts 9, 9 (see Fig. 4) respectively non-rotatively mounted on the right and left threaded portions of a screw shaft 11, rotatably carried in fixed brackets 12, 12 intermediate the length of the machine, and rocking movement from and toward said carrier rods is imparted to said stops by cams 14, 14 on cam shaft 5, through levers 15, 15 operated thereby and connected by rods 16, 16 to a horizontal bar 17 slidably engaging in the rear extensions 18, 18 of the stops 7, 7; this rocking movement permitting the laying of the floats of the split-seam and the depth of the undercut portion 10 determining the number of needles over which the yarn floats, and rotary movement of the screw shaft 11 adjusting the position of said stops 7, 7 in opposite directions. The points where the abutments mounted on the carrier rods normally strike the stops 7—7 are indicated at 10', 10' (Fig. 4).

The screw shaft 11, as more clearly shown in Fig. 9, has an end extension 20 fixedly carrying oppositely toothed ratchet wheels 21 and 22, and loosely strung rockarms 23 and 24 carrying spring-pressed pawls 25 and 26 adapted to engage the respective ratchet wheels 21 and 22, a notched disk 25' (Figs. 3 and 12) and a detent 26' held yieldably in engagement with the disk in conventional manner, being preferably employed to prevent accidental turning movement of said shaft 11. In other words, the screw shaft 11 may be positively moved backward or forward by the ratchet wheels 21 and 22 but said shaft, by reason of the teeth upon said disk 25', is locked against accidental turning movement at all times. (See Figs. 1 and 3.) Pattern-control means, hereinafter fully described, determines the selective engagement of the pawls, and connecting links 27 and 28 (see Fig. 8) respectively connect the rockarms 23 and 24 (see Fig. 2) to actuating levers 29 and 29a. Rollers 30 and 31 (see Figs. 1 and 5) having a limited longitudinal movement on their respective lever-carrier studs 32 and 33, are adapted to ride upon special cams on cam shaft 5, said cams having idle paths 34 and 35 and active paths 34a and 35a for the respective rollers, (see Fig. 5) to cause intermittent rotation of the screw shaft 11 as desired. Arms 40 and 41 loosely engaging the hubs of rollers 30 and 31 and carried by horizontal shaft 42, jointly move said rollers across their respective idle cam faces 34 and 35, and a spring 43 tends to impart longitudinal movement to said shaft 42 in one direction, while a cam 45 on cam shaft 5, through bell crank 44, imparts return movement to said shaft.

To automatically control the movement of this shaft 42 and thereby control the intermittent rotation of screw shaft 11, I employ, as shown, a pattern chain 50, (see Figs. 1, 2 and 7) to which step-by-step movement is imparted from cam shaft 5 through cam 51 and link connected lever 52, (see Fig. 1) the latter having a pawl 53 acting on the ratchet teeth of chain supporting wheel 54. Studs 55 on said chain are adapted to act upon a lever 56, carrying a shaft latch-member 57, to raise and lower the latter. This latch 57, as best shown in Fig. 7, slidably bears against a fixed shaft-supporting bracket 58, and when in lowered position the wide part of the latch engages a collar 59 fixed on said shaft 42 to hold the shaft 42 and its arms in a position where the rollers 30 and 31 are on the idle faces 34 and 35 of the cams.

When a stud 55 on said chain 50 lifts lever 56 and its shaft latch member 57, the reduced lower end 60 of the latch permits the spring 43 to move said shaft until the rollers 30 and 31 ride on the active paths 34a, and 35a, of their respective cams. Upon the passing of the stud 55, the wide part of the latch member 57 will fall again into engagement with collar 59, when the shaft 42 is again moved to the right by action of cam-actuated bell crank 44. The number of studs 55 on chain 50 will determine the number of rotations of the screw-shaft 11 and the movement of the nuts 9—9, to shift the stops 7—7 controlled thereby, toward and from one another in a direction crosswise of the wales of the knitted fabric.

To cause selective engagement of the pawls 25 and 26 before referred to, and thereby determine the direction of rotation of screw-shaft 11, I preferably employ as shown, a second pattern chain 70, to which step-by-step movement is imparted by the operation of cam 35a on a lever carrying the pawl 71 (Fig. 1) to impart movement to the ratchet wheel carrying the pattern chain aforesaid having studs 72 operating a spring-pressed lever 73 (Figs. 6 and 8). Wires 74 and 75 extending over suitable pulleys, connect the lever 73 to the respective spring-pressed pawls 25 and 26, so that the movement of said lever 73 (as determined by the presence or absence of a stud 72, causes one or the other pawl to engage with its respective ratchet wheel 21 or 22) to impart the desired direction of rotation to the screw 11 through the intermittently acting levers 29 and 29a which operate

the respective pawls. A spring 74' holds the lever 73 in the position shown when no button 72 is acting on the downwardly projecting lug of the lever.

From the foregoing description it will be seen that the yarn-guide controlling stops employed in my novel attachment may be moved from and toward each other by direct cam shaft action to cooperate with the usual knitting mechanism in producing the desired spliced or split-seam ornamentation of the adjacent fabric sections, and their relative adjustment from and toward one another automatically controlled and intermittently effected in successive courses. My novel split-seam stops, it will be understood, are employed in producing fabrics having sections of separate yarns of which for illustrative purposes one type is shown in Fig. 10, or spliced areas as shown in my said patent. In the particular illustrative fabric shown in Fig. 10, three yarn carrier rods have been employed for making a split seam fabric, each having a yarn guide supplying yarn only to its respective section A, B, or C, and my oppositely movable split seam stops have caused the interlooping of these yarn sections to form the reversely inclined split seam border lines D.

Each of the carrier bars for sections A and C is stopped on its outward movement by the conventional end stops at the ends of the machine and on its return movement by a stop 7. The carrier rod for section B has an abutment or abutments moving between stops 7, 7 and striking against one or the other at the ends of its throw. It would also be possible to provide abutments on this last-named rod outside the stops so as to strike alternately against the outer faces of the stops. Additional sections could readily be provided for by equipping differently located abutments so that the travel of the guides would cover different vertical stripes or yarns of the fabric.

Mounted on a stud 98 adjacent the main cam shaft 5* is the usual lever cam 99 which controls the narrowing mechanism, and attached thereto, is an arm 92 (Figs. 11 and 12) which when the lever cam goes into action moves in the direction of the arrow (Fig. 11) against the collar 93 moving therewith the shaft 94 and the block 95 attached to the end thereof, into the path of travel of the collar 96 fixed to the shaft 42* and prevents same from operating. It will thus be seen that during the narrowing of the stocking the shaft 42* which controls the operation of the design mechanism is prevented from working. A spring 97 tends to normally hold the block 95 out of the path of collar 96.

The purpose of preventing operation of the screw-actuating means at this time arises out of the fact that if such means should happen to operate during narrowing the sinkers would cut off the yarns at the fabric and so cause press-offs and seconds.

What I claim is:

1. In a straight knitting machine having cooperating yarn guide carrier bars, a pair of opposed stops for certain of said carrier bars which have a stroke less than the full width of the fabric being knitted, and a reversely threaded spindle for moving said stops toward and from each other to vary the stroke of the bars controlled by said stops.

2. In a straight knitting machine having cooperating reciprocatory yarn guide carrier bars, a reversely threaded spindle, stops connected to the spindle positioned to limit the traverse of certain of the cooperating carrier bars to less than the full width of the cloth being knitted, and pattern controlled means for turning said spindle to vary the distance between said stops.

3. A device as in claim 2, said pattern controlled means being constructed and arranged to turn said spindle either to increase or to decrease the distance between said stops.

4. In a straight knitting machine, yarn guide carrier bars having a stroke less than the full width of the fabric being knitted, abutments on said carrier bars, a reversely threaded spindle, opposed stops for engagement by said abutments, said stops being operated by the reversely arranged threads of said spindle to vary the distance between them, and pattern controlled means for rotating said spindle.

5. In a straight knitting machine having guides for one or more yarns knitted in for less than the full length of a course, the combination of carrier bars for said guides, a reversely threaded spindle parallel to said bars, stops in the path of said abutments said stops being connected to the reversely threaded parts of said spindle, and pattern controlled means for rotating said spindle to vary the distance between said abutments.

6. In a straight knitting machine, yarn guide carrier bars including one or more bars having a stroke less than the full width of the fabric being knitted, abutments on said carrier bars, a reversely threaded spindle, opposed stops supported on the reversely threaded portions of said spindle for engagement by said abutments, and means for rotating said spindle.

7. In a straight knitting machine having reciprocating yarn guide carrier bars, a reversely threaded spindle, stops connected to the spindle positioned to limit the traverse of certain carrier bars, pattern controlled means for turning said spindle, and means for preventing operation of said means during the narrowing operation.

8. In a straight knitting machine having reciprocating yarn guide carrier bars, a reversely threaded spindle, stops connected to

the spindle positioned to limit the traverse of certain carrier bars to a distance less than the width of the fabric being knitted, pattern controlled means for turning said spindle in either direction, and means for preventing operation of said means during the narrowing operation.

9. In a straight knitting machine, a set of yarn guide carrier bars, stops for said bars said stops having undercut portions normally out of operative relation to said bars, means for moving said stops toward and from each other, and means to move the stops so as to bring the undercut portions into operative relation to said bars, thereby permitting delayed additional movement of said bars.

10. In a straight knitting machine, a set of yarn guide carrier bars, pivoted stops for said bars said stops having undercut portions, means whereby the stops may be caused to approach or recede from each other, and pattern-controlled means to tilt the stops to bring the undercut portions into operative relation to said bars, thereby permitting delayed additional movement of said bars.

11. In a straight knitting machine, a set of yarn guide carrier bars, a reversely threaded spindle parallel to said bars, nuts on the reversely threaded portions of said spindle, stops operated by said nuts for limiting the movement of said carrier bars said stops having undercut portions, pattern controlled means for rotating the spindle to vary the distance between the stops, and means for moving the stops so as to bring the undercut portions into operative relation to said bars thereby permitting delayed additional movement of said bars.

12. In a straight knitting machine, a set of yarn guide carrier bars including one or more bars having a traverse less than the width of the fabric being knitted, a threaded spindle, a stop for limiting the traverse of a carrier bar in one direction said stop having an undercut portion and being connected to said spindle, means for turning the spindle to move the stop lengthwise of the bar to vary the traverse of the bar, and means for moving the stop to bring the undercut portion into operative relation to said bar to permit delayed additional movement of the bar.

13. In a straight knitting machine, a set of yarn guide carrier bars including one or more bars having a traverse less than the width of the fabric being knitted, a threaded spindle, a nut on the spindle, a stop pivotally supported by the nut for limiting the traverse of a carrier bar in one direction said stop having an undercut portion, means for turning the spindle to move the stop lengthwise of the bar to vary the traverse of the bar, and means for moving the stop on its pivot to bring the undercut portion into operative relation to said bar to permit delayed additional movement of the bar.

14. In a straight knitting machine, a set of yarn guide carrier bars for operating yarn guides traveling less than the full width of the fabric being knitted, a spindle having reversed screw threads, stops operated by said spindle, means for turning the spindle in either direction, pattern-controlled means for determining the time of operation of the spindle, and pattern-controlled means for determining the direction of rotation of the spindle.

15. In a straight knitting machine, a set of reciprocating yarn guide carrier bars including bars having a stroke less than the width of the fabric being knitted, pair of stops for said guides, a reversely threaded spindle extending lengthwise of the machine, the respective stops being connected to the reversely threaded portion of the spindle for moving the stops simultaneously toward and from each other, pattern controlled means for determining the time for such movement, and correlated pattern controlled means for independently determining the direction of such movement.

16. In a straight knitting machine having a main cam shaft, a set of yarn guide carrier bars, a spindle having reversed screw threads, stops connected to said spindle said stops limiting the travel of the carrier bars, means for turning the spindle in either direction, pattern-controlled means for determining the time of operation of the spindle including a rod extending lengthwise of the machine, connections from the main cam shaft for moving the rod in one direction, a detent for holding the rod, and means including a pattern chain for releasing the detent to permit the rod to return.

17. In a straight knitting machine, a set of yarn guide carrier bars, a spindle having reversed screw threads, stops connected to the spindle said stops limiting the travel of said carrier bars, reversible pawl and ratchet means for turning the spindle, pattern-controlled means for determining the time of operation of the spindle including a rod extending lengthwise of the machine, connections from the main cam shaft for moving the rod in one direction, a detent for holding it, means including a pattern chain for releasing the detent to permit the rod to return, means for determining the direction of rotation of the spindle including a second rod parallel to the first, means on the first rod for moving the second in one direction, a detent for holding the second rod, and connections from said pattern chain for releasing the second rod.

18. In a straight knitting machine having cooperating yarn guide carrier bars, a pair of opposed stops for a carrier bar having a stroke less than the full width of the fabric being knitted, and a rod-like element having

means to move said stops toward and from each other longitudinally of said element and to hold said stops at various distances from each other.

19. In a straight knitting machine having cooperating yarn guide carrier bars, means for making a fabric with sections connected by suture seams including a pair of opposed stops for a carrier bar supplying yarn to one of said sections, and a reversely threaded spindle for moving said stops toward and from each other to vary the stroke of said bar.

20. In a straight knitting machine having cooperating reciprocatory yarn guide carrier bars, means for knitting a fabric with sections connected by suture seams including a reversely threaded spindle, stops connected to the spindle positioned to limit the travel of a carrier bar supplying yarn to one of such sections, and pattern controlled means for turning the spindle to increase or decrease the distance between said stops.

21. In a straight knitting machine having cooperating yarn guide carrier bars, means for knitting a fabric with sections connected by suture seams including a pair of opposed stops for a carrier bar supplying yarn to one such section, and a rod-like element carrying the stops, and means to move said stops toward and from each other longitudinally of said element and to hold said stops at various distances from each other.

22. In a full fashioned knitting machine comprising a plurality of thread-carrier rods, stop-mechanism for said rods comprising a pair of oppositely traversing split-seam stops which at every step of traverse move toward or away from each other, means for moving said stops from and towards the rods to effect the split-seam interlooping of adjacent fabric sections, and means for intermittently moving said stops to reversely incline the split-seams to the lines of the wales.

23. In a full fashioned knitting machine comprising a plurality of thread-carrier rods, stop-mechanism for said rods comprising a screw shaft having reversely-threaded portions carrying oppositely movable split-seam stops adapted to control the split-seam interlooping of adjacent fabric sections, and means for intermittently actuating said screw in successive courses to reversely incline the split-seams to the lines of the wales.

In testimony whereof, I have hereunto signed my name.

RICHARD E. SCHLETTER.

DISCLAIMER

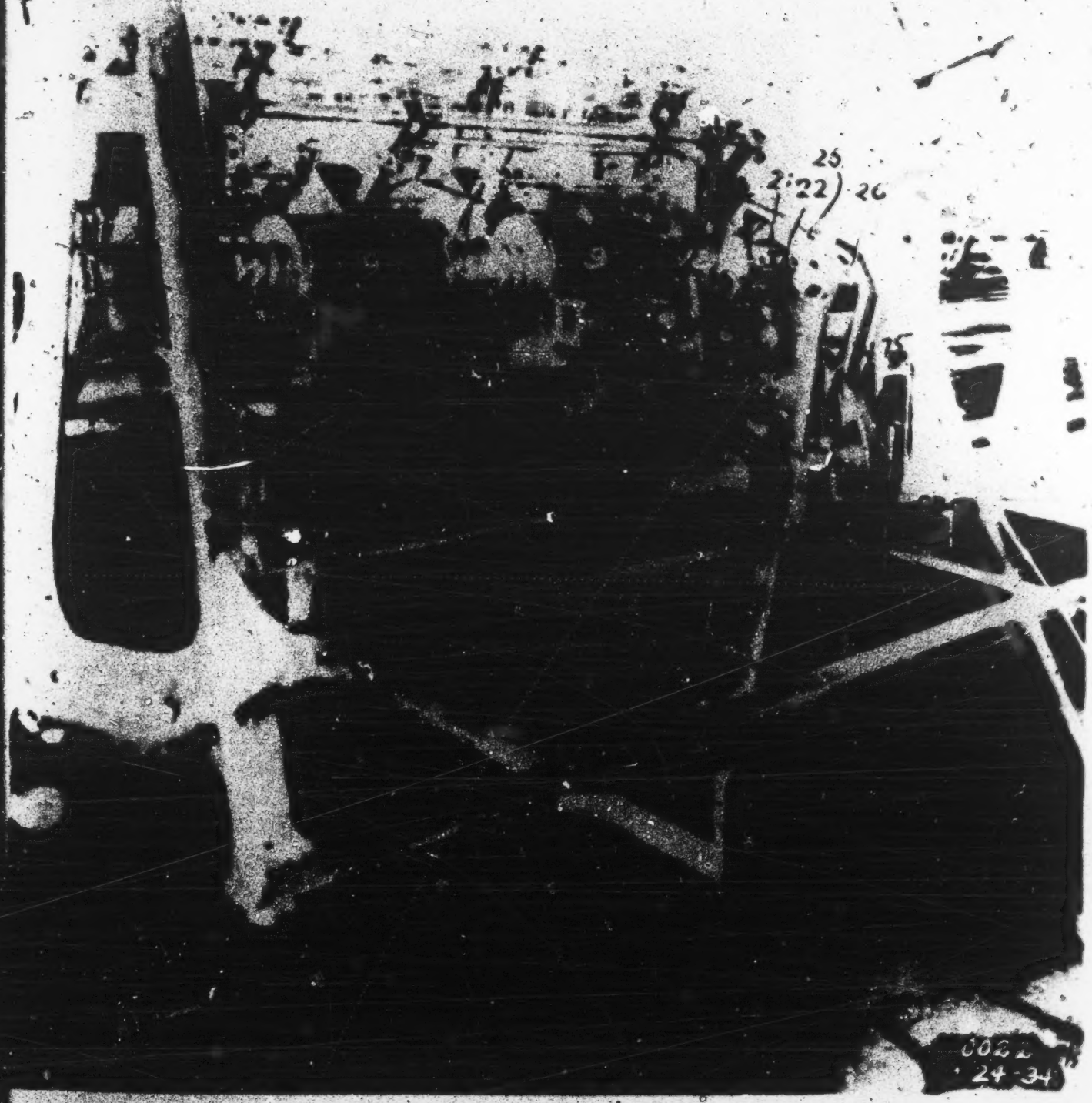
1,713,638.—*Richard E. Schletter*, Philadelphia, Pa. ATTACHMENT FOR FLAT-KNITTING MACHINES. Patent dated May 21, 1929. Disclaimer filed January 18, 1936, by the assignee, *Textile Machine Works*.

Hereby enters this disclaimer to claim 10 of said Letters Patent.

[*Official Gazette February 25, 1936.*]

[fols. 505-515]

PLAINTIFF'S EXHIBIT NO. 2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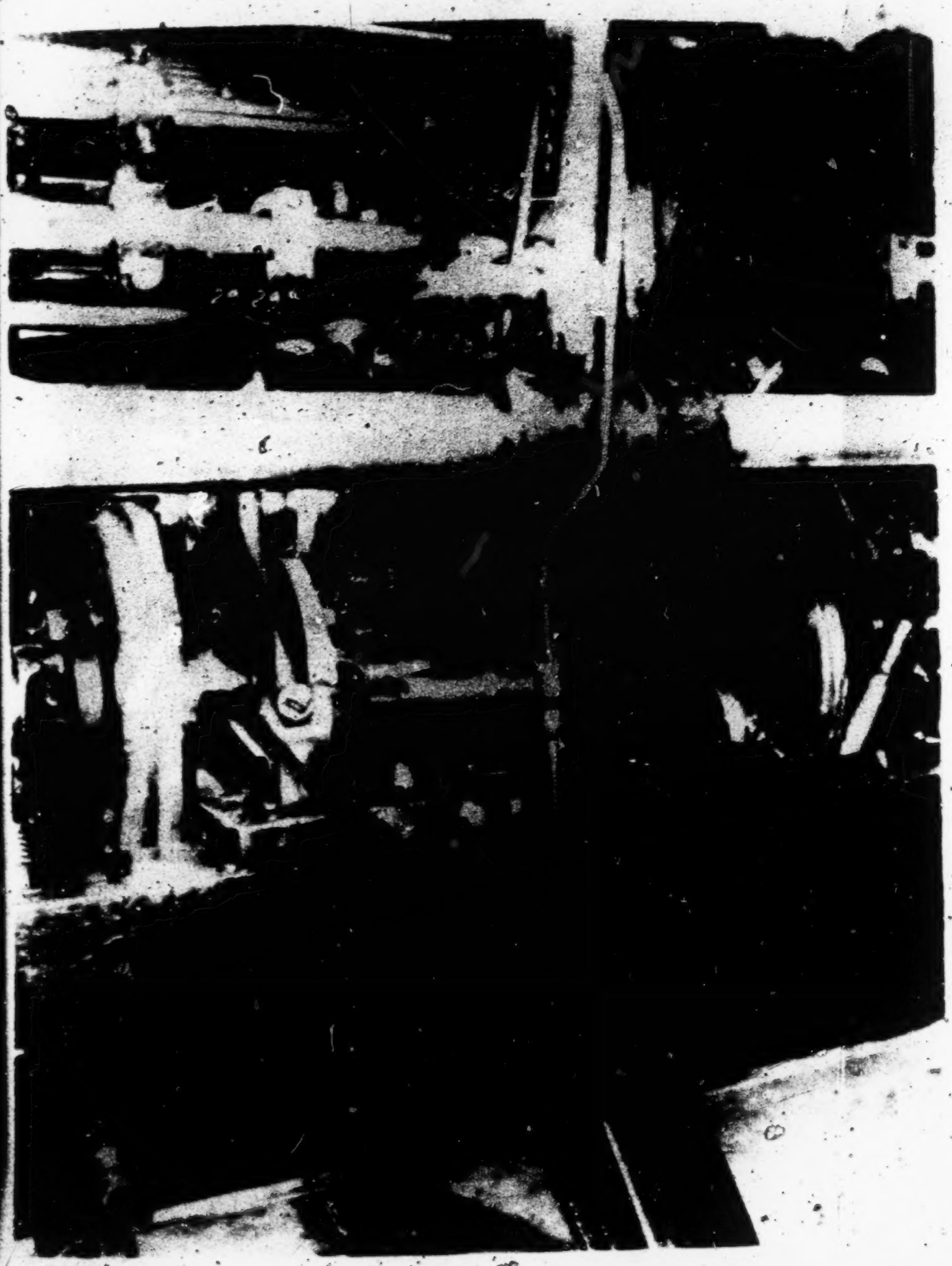

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PLAINTIFF'S EXHIBIT NO.
CARRIER MOTION
SCALE: HALF SIZE

Fig.1

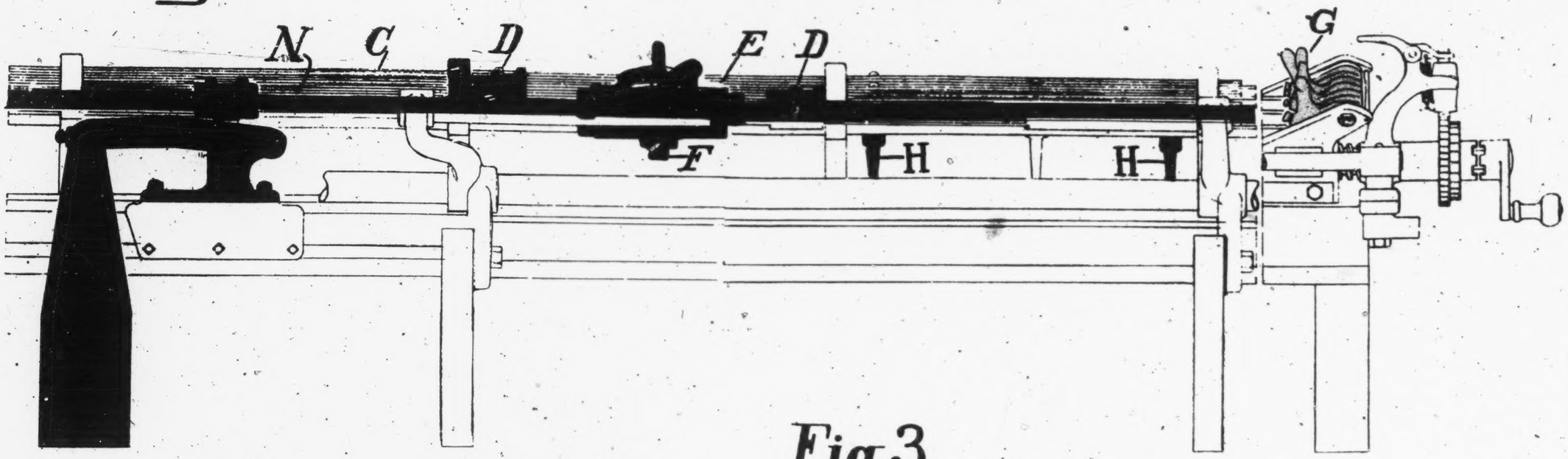


Fig.2.

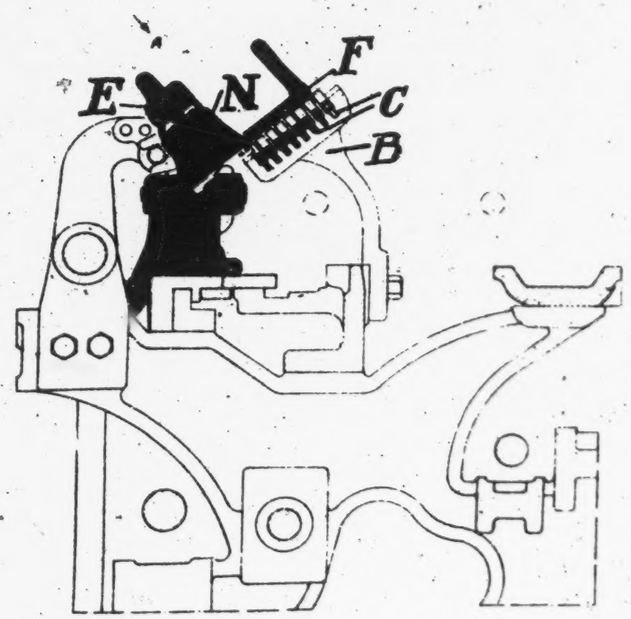
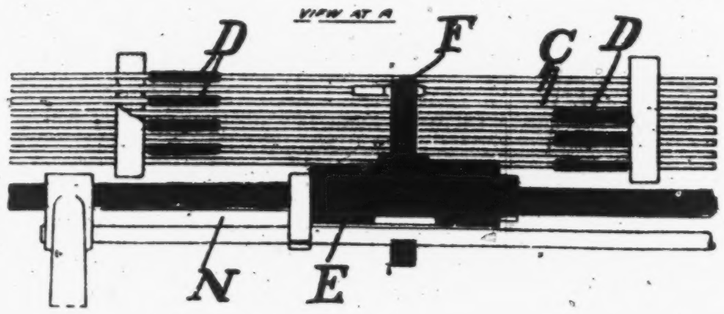


Fig.3.



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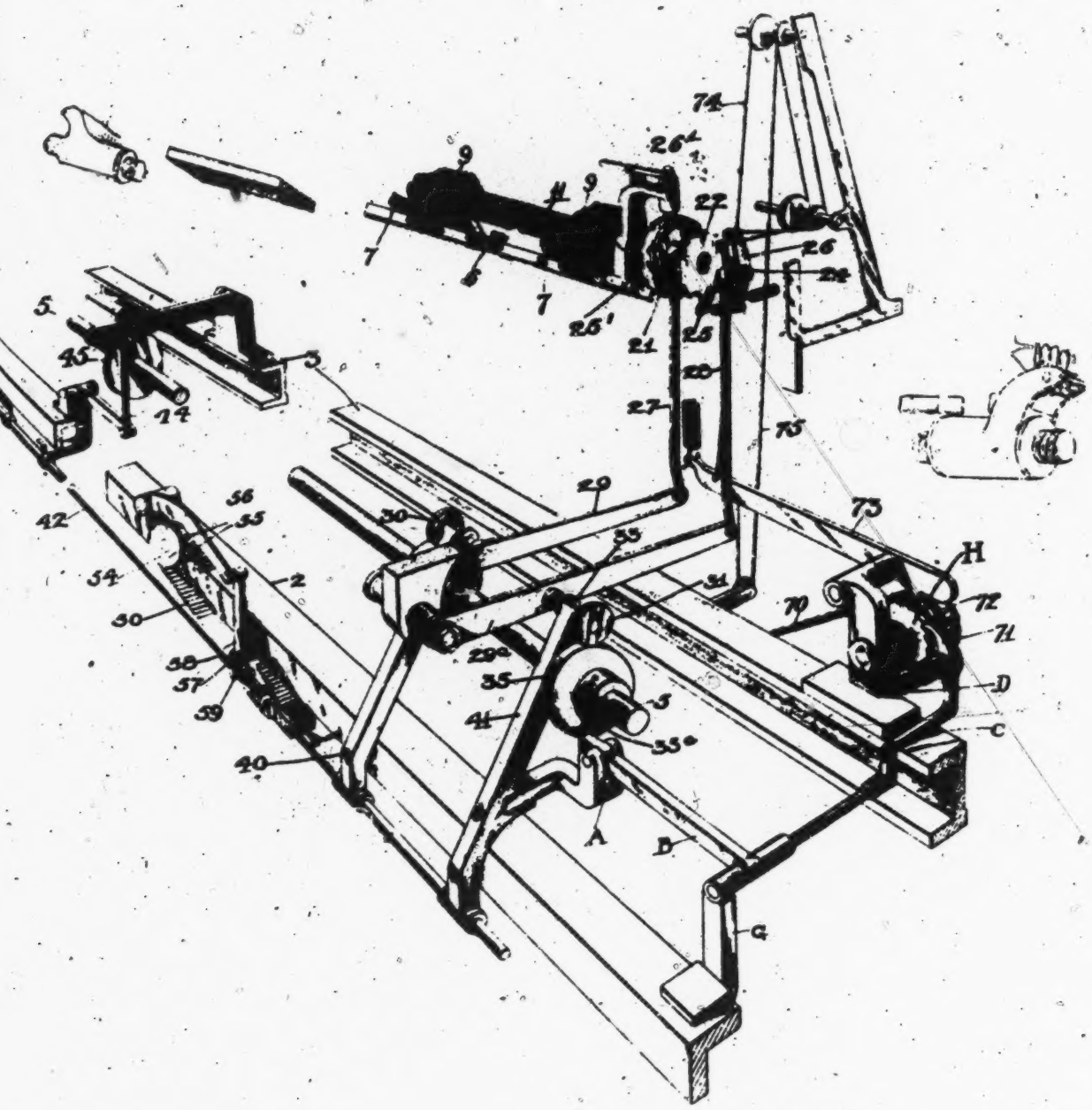
Enlarged drawing of Schletter's Attachment.



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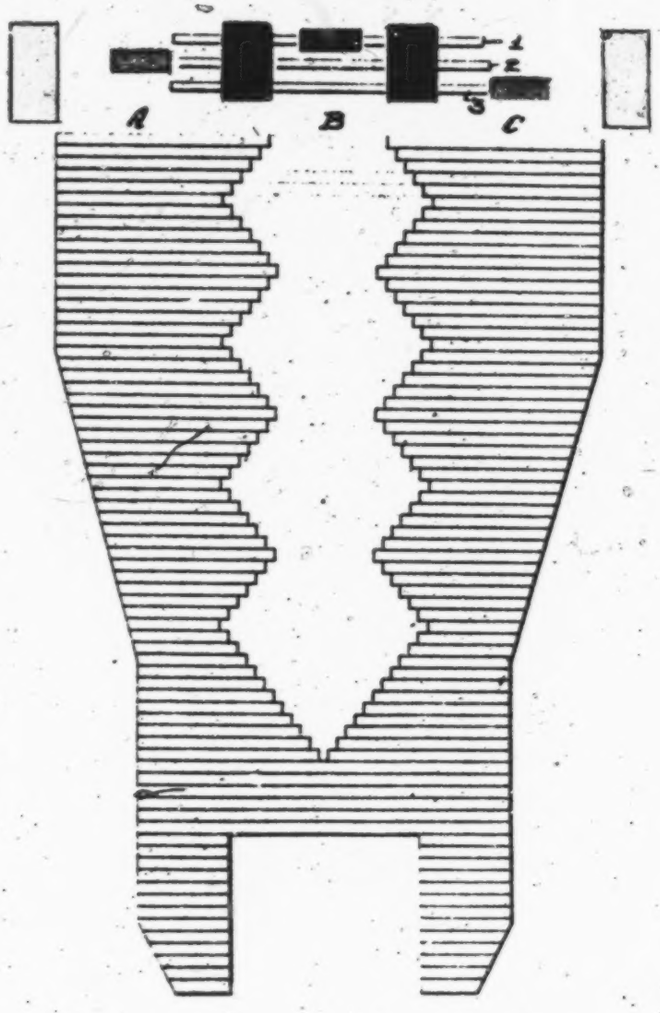

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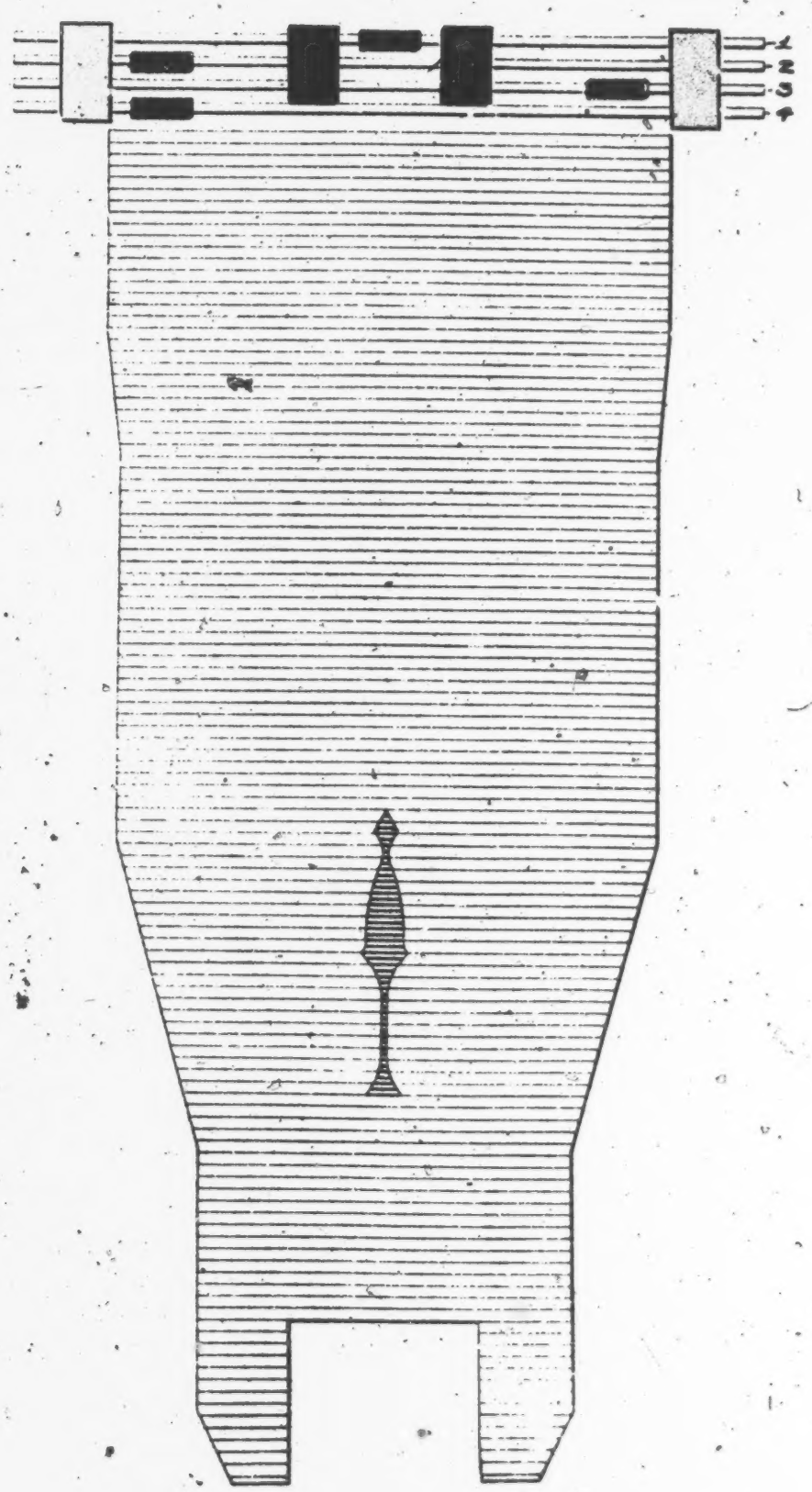

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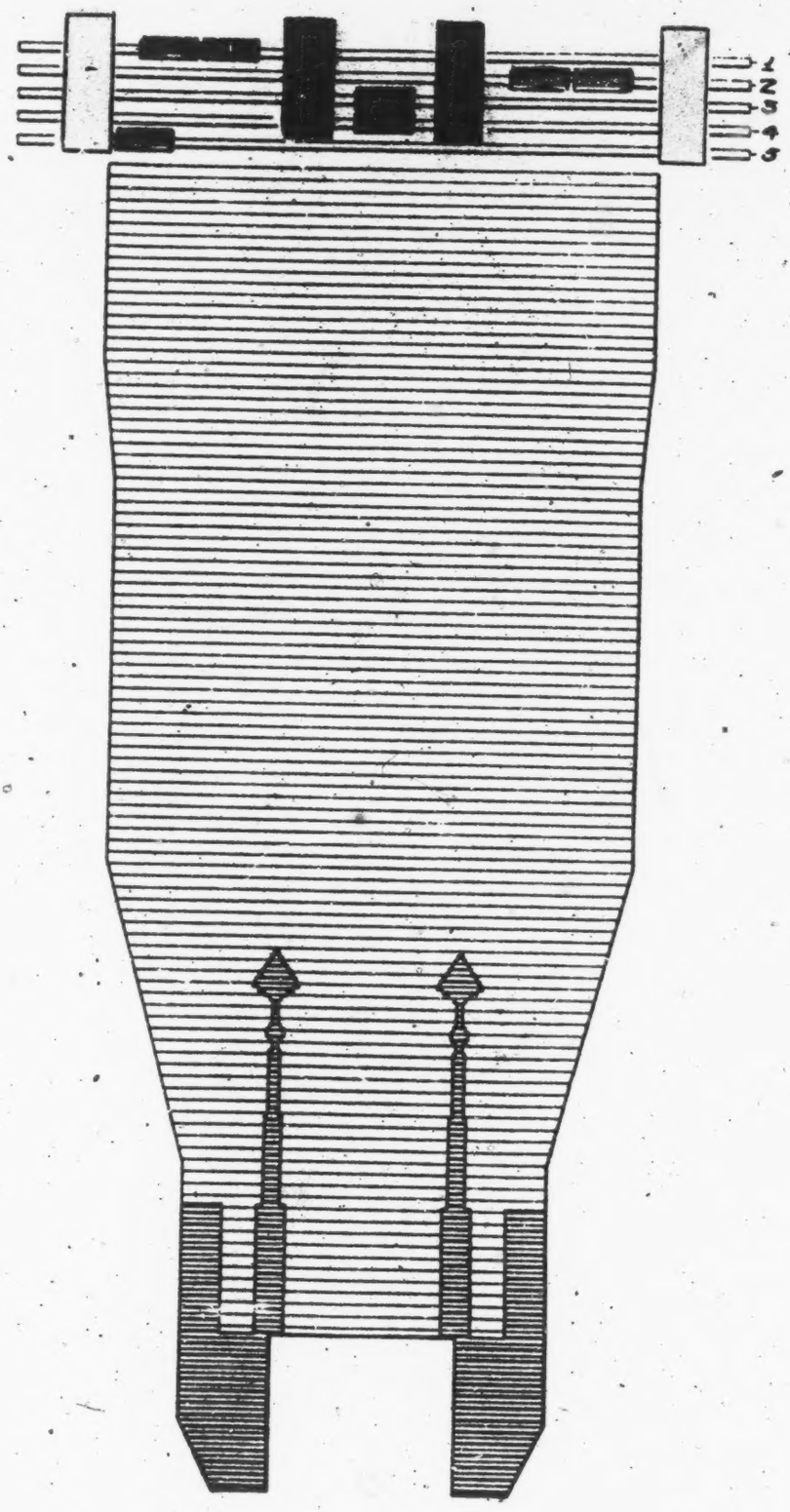

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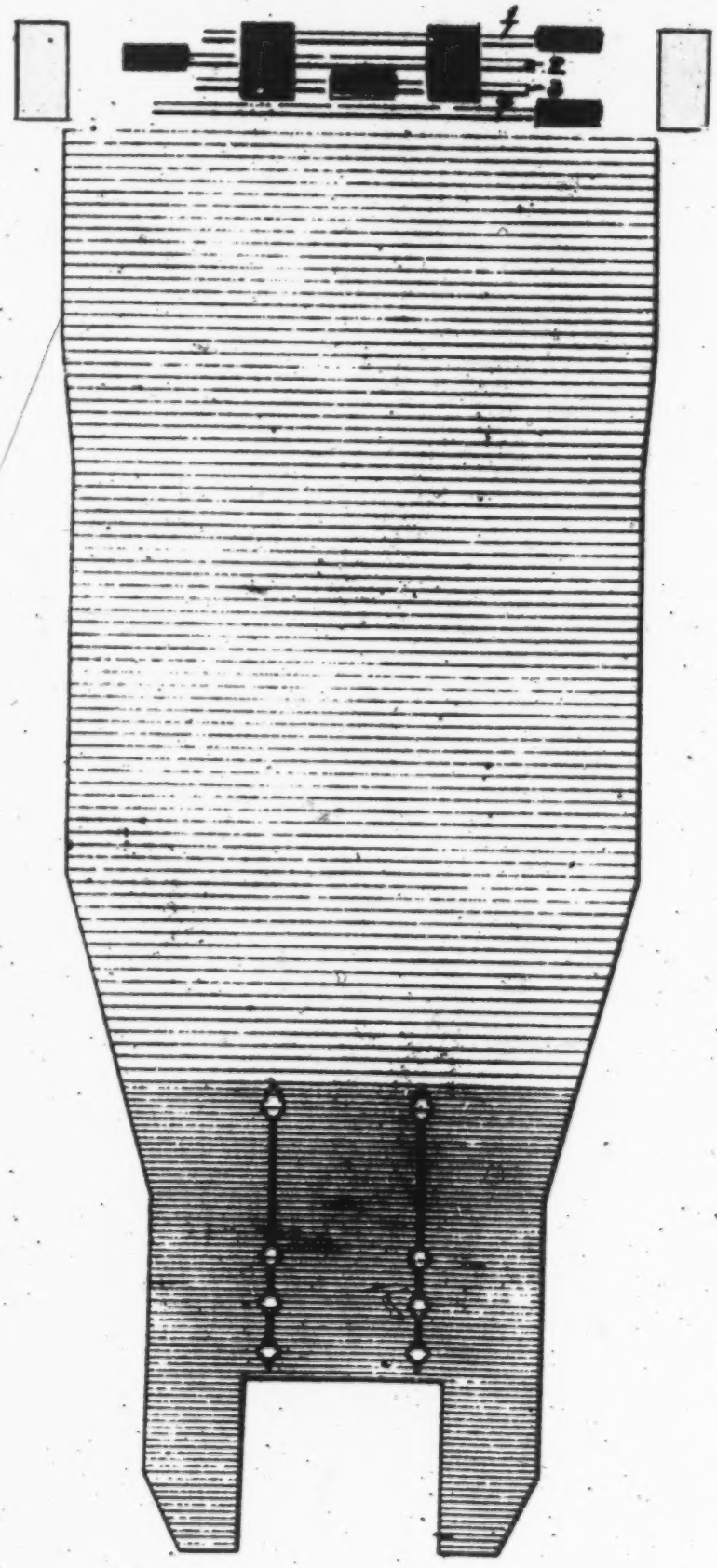

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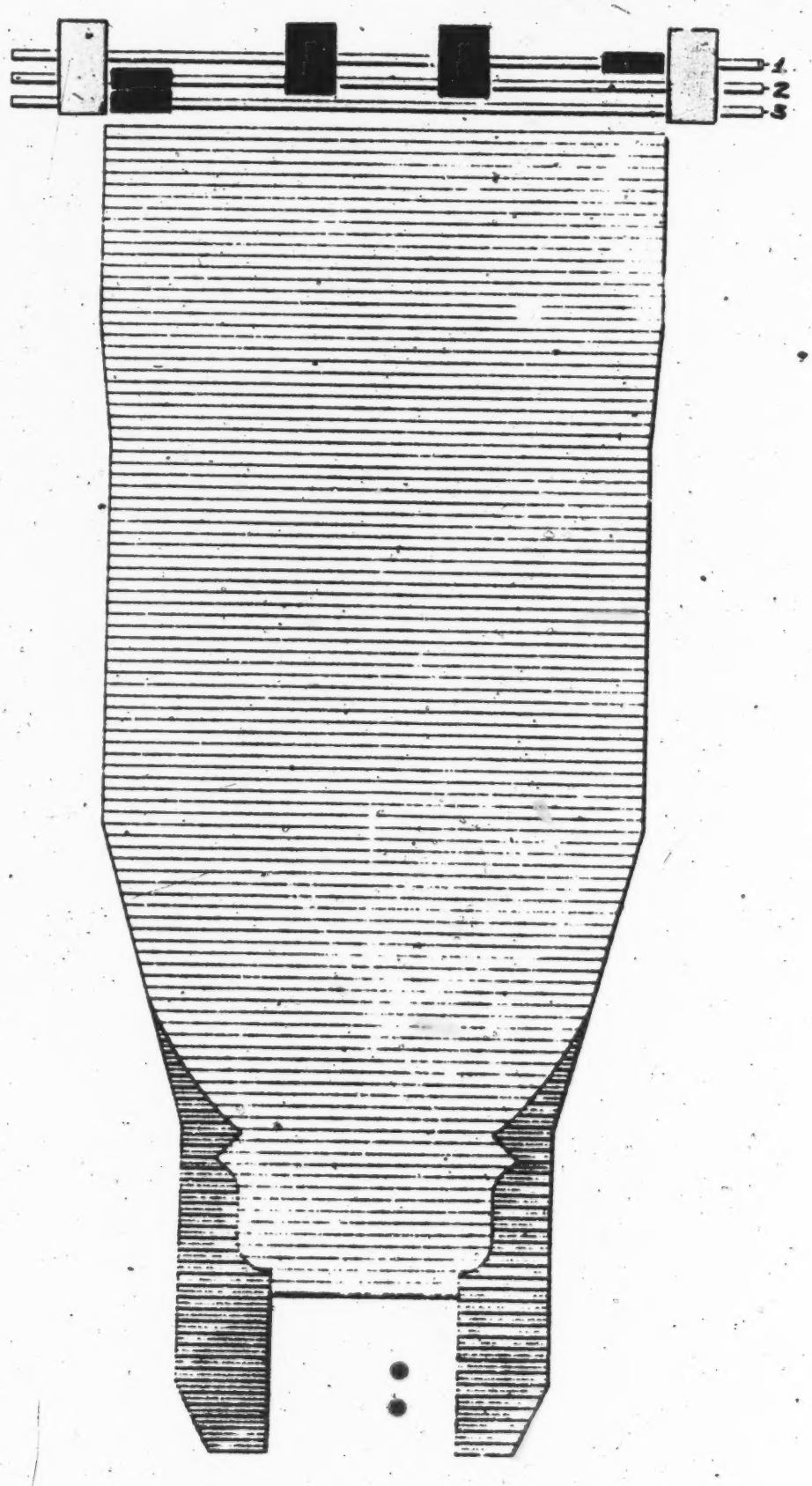

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Complete stocking blank

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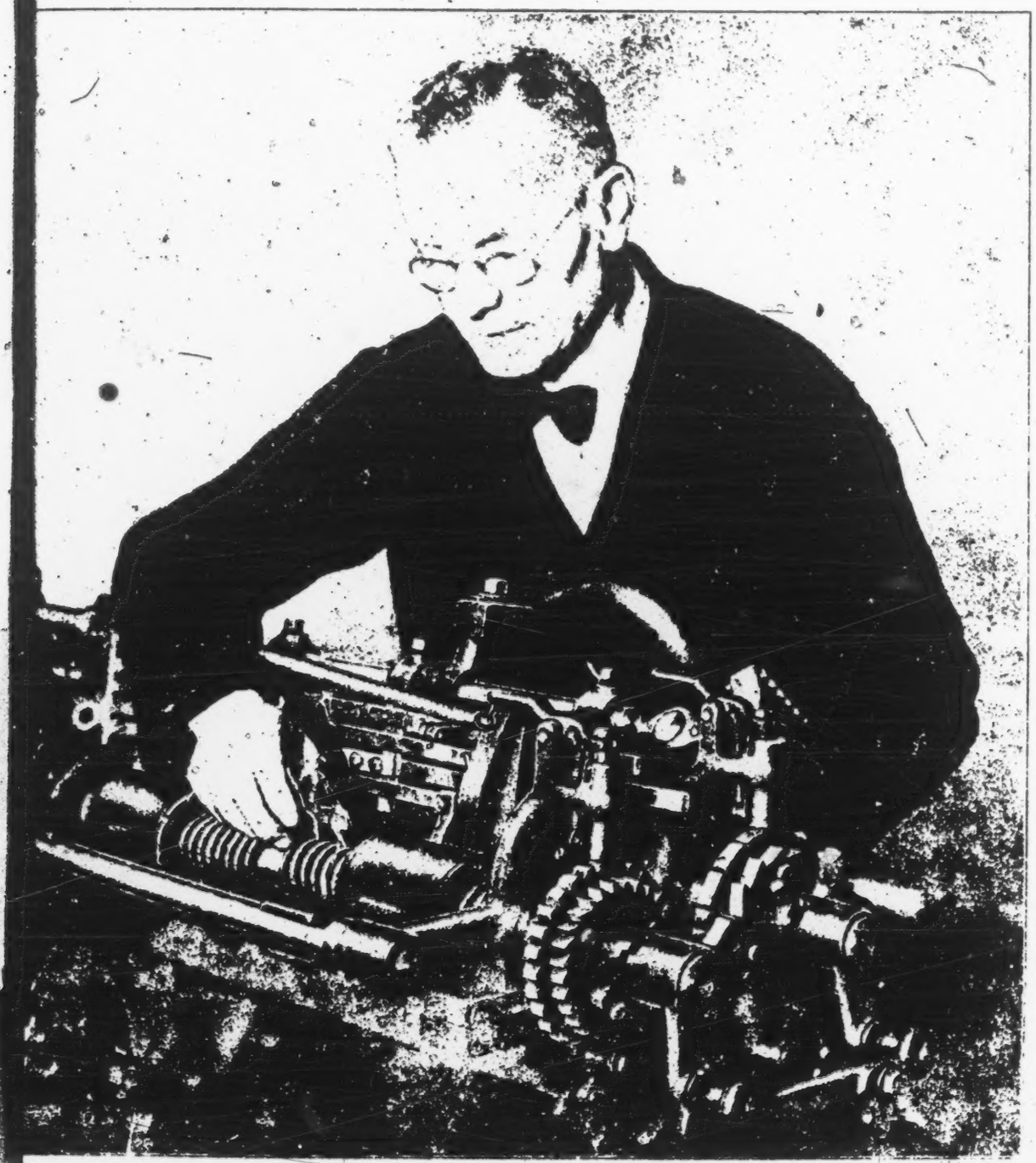
The "READING" RECORD

VOL. I FEBRUARY, 1930 NO. 2



"Accuracy First, Cost Second"

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"ACCURACY FIRST, COST SECOND"

Accuracy is one of the main features of the "Reading" Full-Fashioned Knitting Machine and no expense is spared in obtaining this end. A staff of highly trained men is maintained who subject every part of the machine to a very rigid inspection schedule. Every part must go out *right*, even though it may mean the scrapping of valuable material.

One of the most exacting parts of the full-fashioned machine is the Narrowing Rod Spindle and the Carrier Rod Spindle. These parts are used for furnishing the proper movement to the Narrowing Points and for changing the Carrier Rod travel when reducing the width of the fabric, therefore, it is necessary that they be absolutely accurate. The slightest imperfection in the Narrowing Spindle would prevent the Narrowing Points from meshing properly with the Needles, thus resulting in menders, or seconds. Periodic tests of the spindles are made by the Bureau of Standards and recent tests have shown that the error in distance between two threads has been only from .0002 to .0004 of an inch.

The highest class of workmanship that it is possible to obtain and the close inspection given to the Narrowing Rod and Carrier Rod Spindles are responsible for this amazing accuracy, and are responsible for the fact that of the several thousand now in use it has not been necessary to replace a single spindle.

The illustration on the front page shows Mr. T. Eberly, head of the Inspection Department, examining one of these spindles before the machine is finally shipped from the plant. Mr. Eberly has been in the employ of Textile Machine Works for 34 years.

SHADOW CLOCK ATTACHMENT

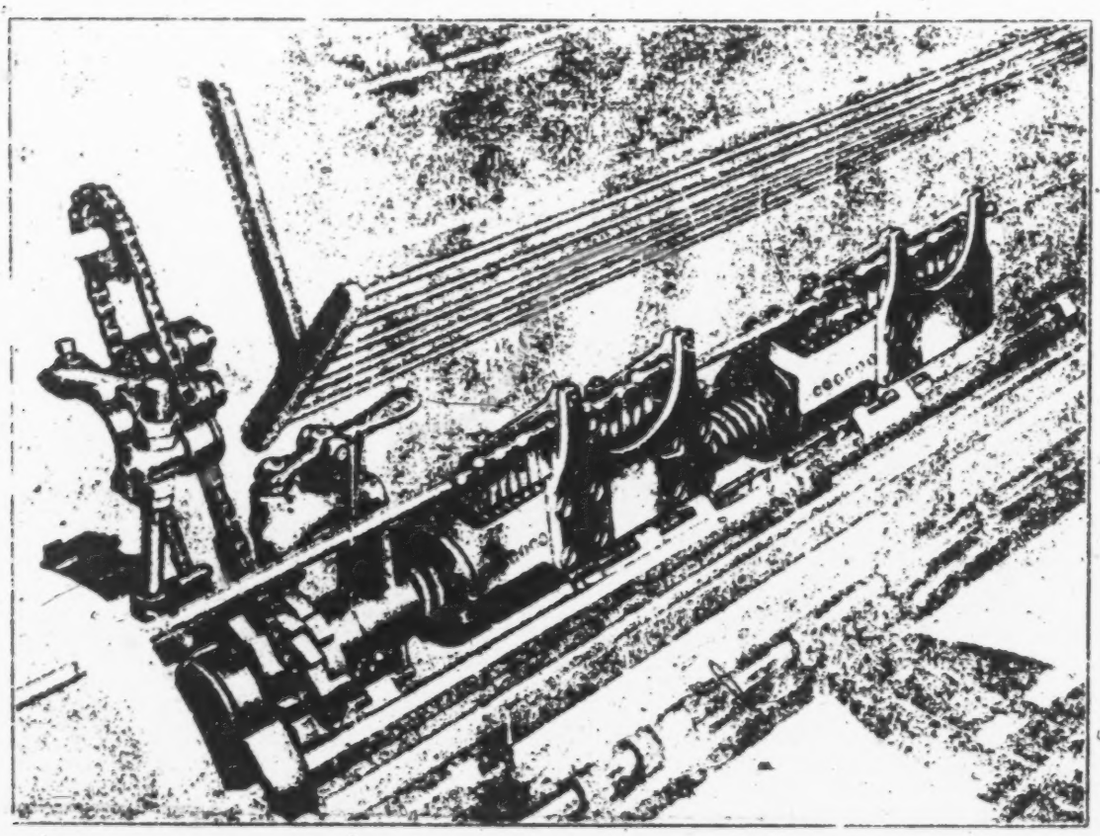

FIGURE 1

The function of the Shadow Clock Attachment is to furnish the additional stops necessary in the formation of closed designs on the fabric, that is, designs that are made by the use of an extra thread, either of the same color as the main yarn or of a contrasting color. An attachment of this type furnishes the means for producing an almost infinite number of fancy heel designs such as those

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hown in the accompanying illustrations. It can lso be used for producing various designs on the oot of the stocking.

"Reading" Shadow Clock Attachments are apable of making numerous reinforcing designs, he lines of which make an angle with the wales and ourses of the fabric and the steps of which cover a pace of two needles for each step. Several arangements have been developed for making such designs, among which are the Single Shadow Clock Brackets for regular left Reinforced Selvage Head and Double Shadow Clock Brackets for regular left and right side Reinforced Selvage Head. Figure 1 shows the Left Side Double Shadow Clock Attachment and Figure 2 shows the Single Shadow Clock Attachment. The only difference between these varying arrangements is that the Double Shadow Clock Brackets on both right and

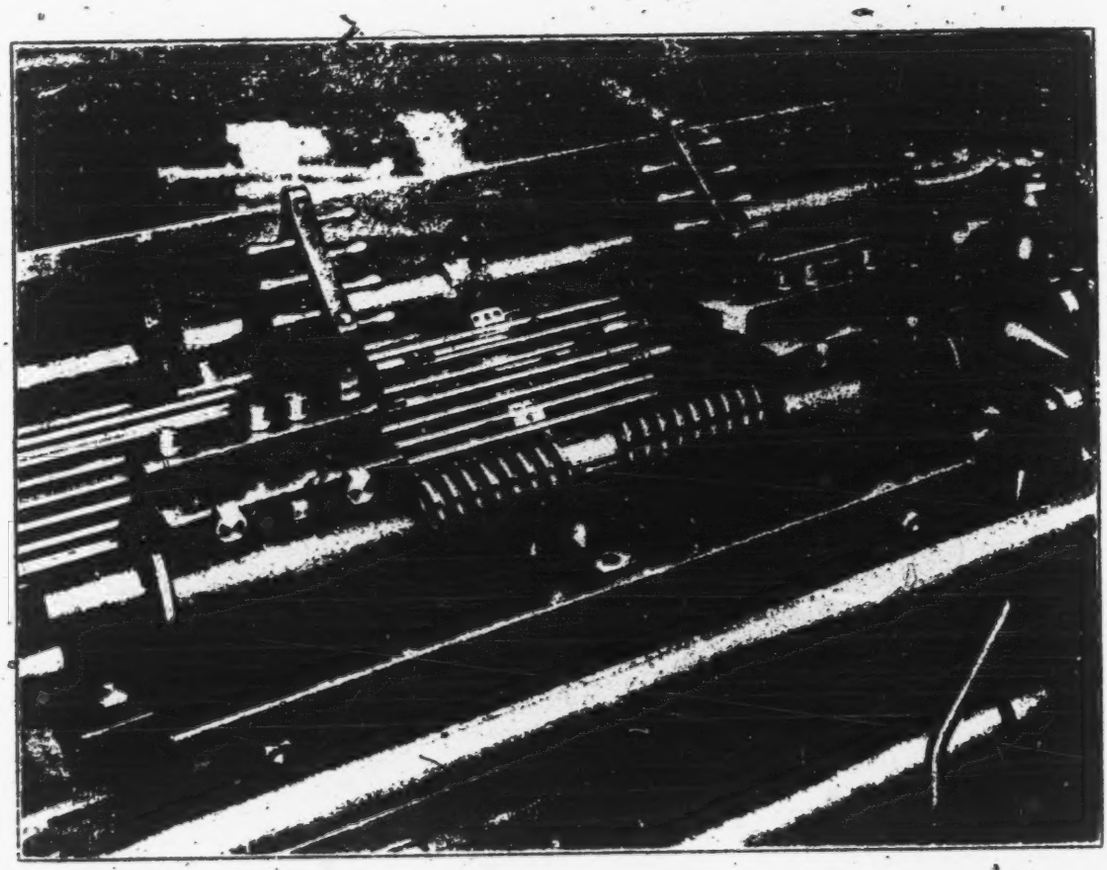
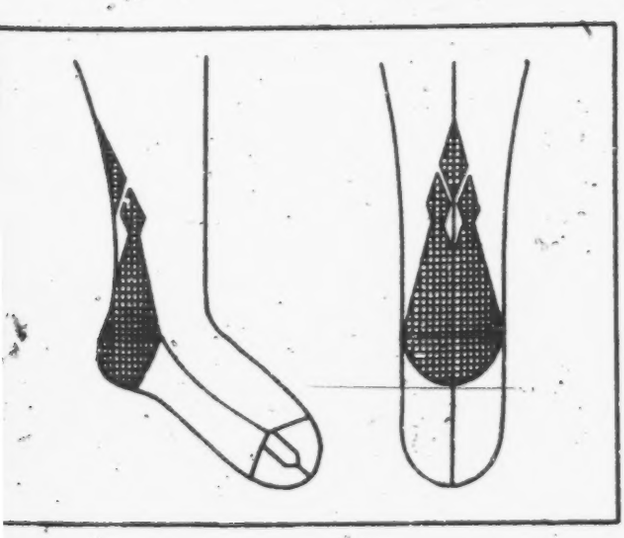


FIGURE 2



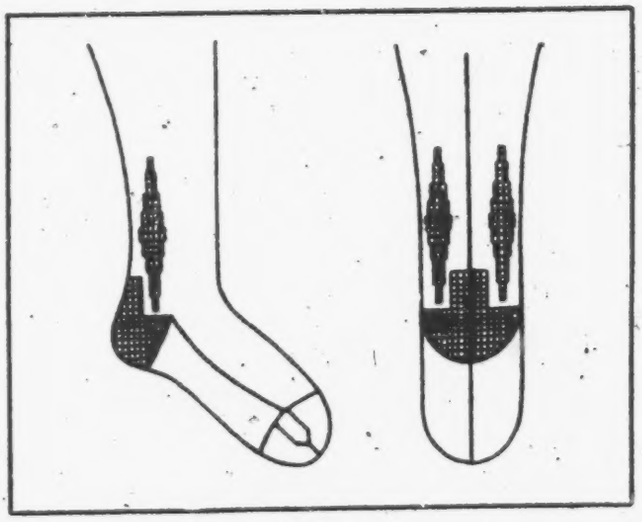


FIGURE 4

left side Reinforced Selvage Heads give a larger number of carrier rod combinations, and of course it is natural that the greater number of carrier rod combinations should be capable of producing a wider range of designs.

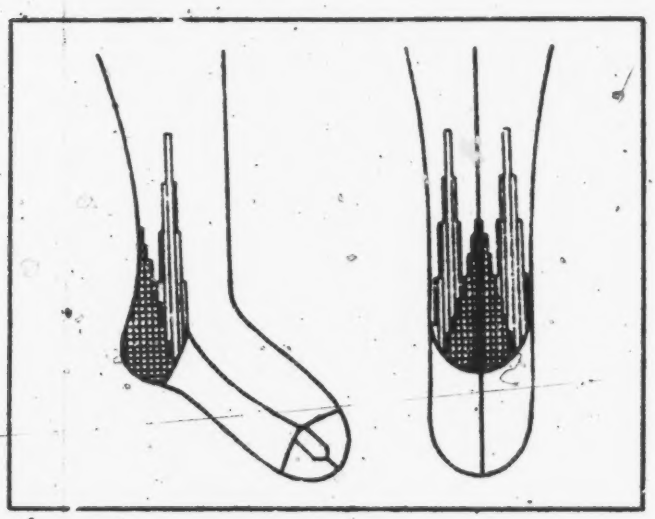


FIGURE 5

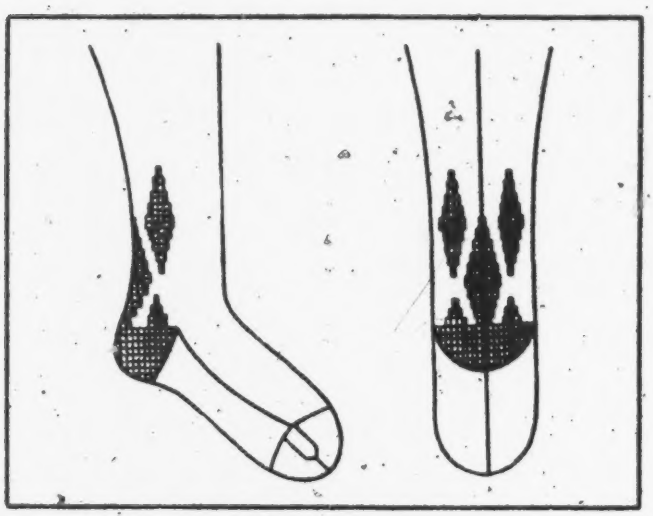


FIGURE 6

A Double Shadow Clock Bracket affords a great advantage over the Single Bracket. Though it is possible to produce many intricate designs with the Single Bracket it is much easier, requires less time, and less expenditure of energy on the part of the knitter when the Double Bracket is used. This is principally because the Single Bracket gives only two stop combinations for each carrier rod, while the Double Bracket gives four. The stop combinations are increased to eight when the Right Side

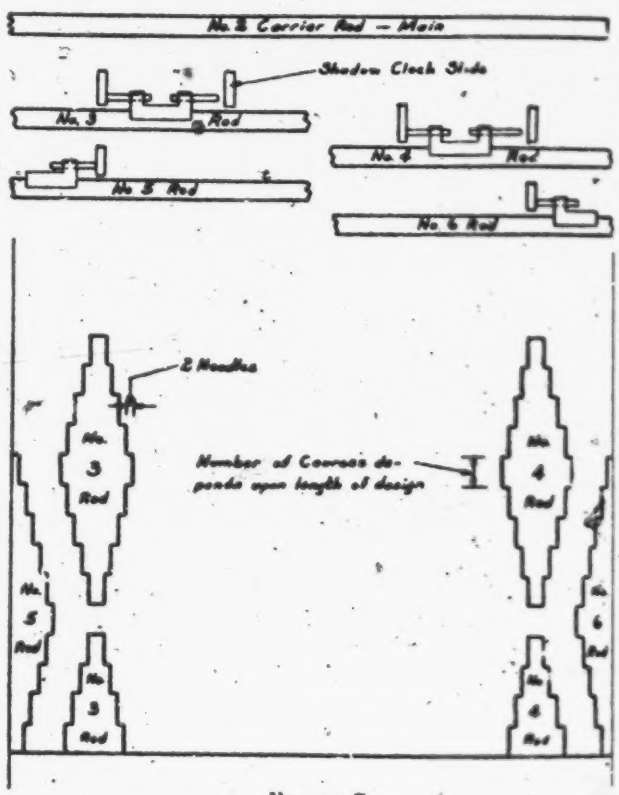


FIGURE 7

Reinforced Selvage Head with Double Brackets is attached to the machine, thus doubling the possibilities of the machine for producing fancy Shadow Clock designs. Other combinations may be obtained by re-setting the carrier rod stops.

Figures 3 to 6 show a few of the heel designs that can be produced with this attachment and Figure 7 illustrates a suggested method of making the design shown in Figure 6. Since the reversing motion and the operation of the Reinforced Selvage Head by the Chain Motion make this a semi-automatic attachment, it would only be necessary to stop the machine to lay in the No. 5 and No. 6 carrier rods.

THE WYOMISSING TRADE SCHOOL

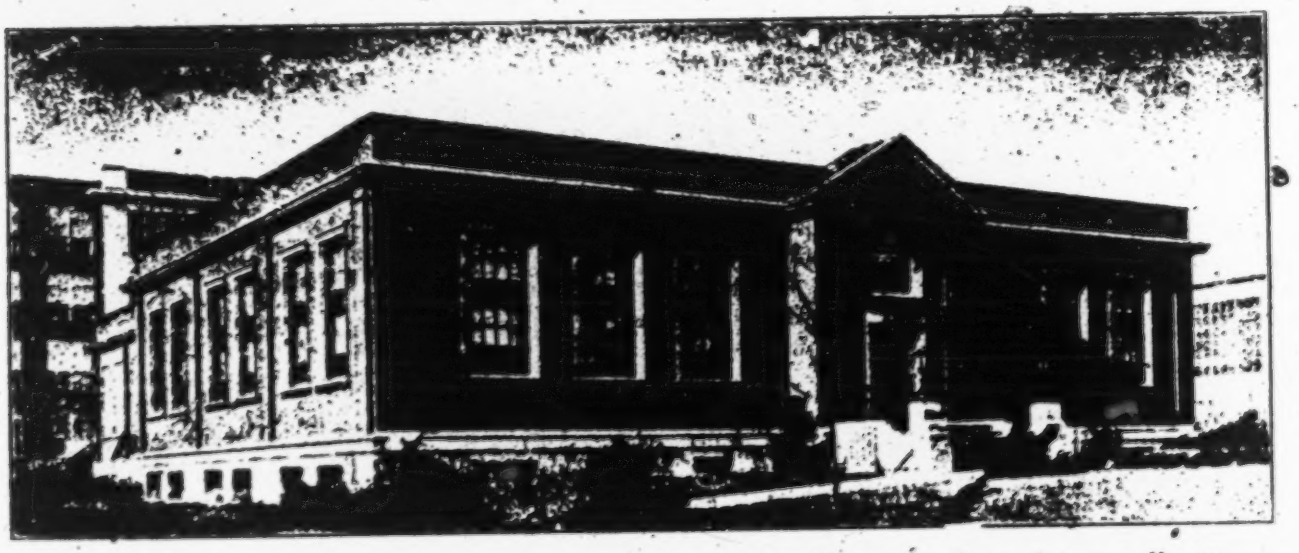
On August 23, 1927, the Textile Machine Works approved a plan establishing the Wyomissing Trade School, then known as the Textile Machine Works' Educational Department.

The object of this school is to develop the very highest type of mechanic possible. Its establishment came about through the scarcity of mechanics skilled in the art of manufacturing, erecting and operating the full-fashioned knitting machine. This shortage is due to the fact that the Textile Machine Works is America's only large manufacturer of this type of machine, and also that

restricted immigration had made it impossible to secure skilled mechanics from abroad. The objective is obtained through a process of cooperative education which supplemented the then existing apprenticeship that had been in successful operation for a number of years.

Cooperative education consists of a series of alternating experiences in the shops and in school. In the shops, the students apply themselves to regular production work, thereby learning the practical end of their trade. In the school they are taught the theoretical bases on which the trade is founded. Correlatively, as the apprentice studies, he learns to apply and as he works, he learns the need of study. This combination of practical work in the shops and theoretical study in the school has been said to be the most perfect education that the world has ever seen. It is not a new movement by any means as it was first practiced in Scotland some 80 years ago, yet it is only recently that the plan has received the attention which its intrinsic advantages merit. In America, it was first used by the University of Cincinnati under Dr. Herman Schneider, in 1906. Since then it has been adopted widely with much success.

In the plan used by the Textile Machine Works, the apprentices are divided into two groups, one of which is working in the shops while the other is attending school and they alternate back and forth every two weeks. Aside from the theoretical training received, a very important advantage of the cooperative scheme is that it virtually doubles the capacity of the shops to train apprentices. In the shops the apprentices are routed through one department after another for a period of four years. During this time they receive experience in as many departments as feasible where they learn the operation of all of the usual types of machine tools such as the drill press, milling machine, lathe, shaper, planer, and a number of other machines of a special type. Correlated with this shop experience is the theoretical work in the school where the apprentices spend one-half of their time for two and one-half years of the four year course. All or part of the first six months is spent in the shops, this being a probationary period in which an attempt is made to determine whether the apprentice is fitted for the trade he wishes to follow. He then spends the next two and one-half years alternating back and forth between shop and school as previously mentioned. All of his fourth year is spent in the shops as it is during this period that he receives his most valuable practical experience. In the school he studies shop mathematics, shop practice, physics, chemistry, mechanical drawing, English, economics, and civics. Shop mathematics includes a study of arithmetic, algebra, trigonometry, mechanics, and the strength of materials; all considered in the light of their relationship to shop work. Shop practice includes a study of the care and use of small tools such as drills, taps, dies, and reamers; precision instruments such as scales, micrometers, calipers, and gauges of various kinds. This study also includes the proper grinding of cutting tools, also the care and operation of the machine tools themselves and such other special features as the chasing of threads and turning of tapers on a lathe and indexing on the milling machine. During the last two semesters the knitting machine itself is taken up in detail. In physics is studied the natural laws by which all machines operate and the object of chemistry is to teach the influences of the elements which enter into the construction of machinery on each other.



Dispensary Building of the Wyomissing Industries in which the Wyomissing Trade School is Housed

By this is meant the demonstration of the harmful influences that phosphorous and sulphur have on cast iron and steel; why carbon, silicon, nickel, manganese, chromium, and other elements exercise a beneficial influence; why brass is used in some cases and bronze in others, etc. In mechanical drawing is taught the usual geometric problems, the intersection and development of surfaces, orthographic projections and in the latter part of the course, the design of cams and special automatic motions such as are so frequently used in the knitting machine. English is included in the course in order to enable the student to express himself briefly yet adequately. Economics is taught in order to give the student an understanding of the laws by which all business—of which industry is a part—is conducted and civics is included in order to make clear the foundations of the American form of government with the object of developing a high type of citizen.

Mechanical Drawing Classroom

Candidates for an apprenticeship must first apply to the employment department of the Textile Machine Works where they are passed upon for their fitness for shop work. Candidates should be boys between 16 and 18 years of age who have had at least two years of high school instruction—more is preferred—who are physically fit and whose eyesight is unimpaired. After qualifying from the shop viewpoint, candidates are sent to the Medical Department, where their physical fitness is passed upon and finally to the Trade School where they are given an examination to determine their mental qualifications. Having successfully passed these various barriers, the candidate is admitted to an apprenticeship and starts as soon as conditions permit. As the number of applicants is greater than the capacity of the shops to train apprentices, a very careful selection is made and a waiting list is maintained. The first group of 22 completed the work of the school last July. Most of these are in the tool room, on the erecting floor or in the drafting room of the Textile Machine Works indicating that successful careers are ahead of those who properly apply themselves.

During the apprenticeship, the rates of pay are 25, 28, 30, and 33 cents per hour for the first, second, third, and fourth year respectively and these rates are paid for the time spent in the school as well as for time spent productively in the shops. Inasmuch, however, as the number of hours spent per week in the school is less than the number of hours per week in the shops, the actual compensation while attending school is proportionately less. Forty-four hours constitutes a school week

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and fifty-seven and one-quarter a shop week. In addition, a two hour bonus is paid per week for perfect attendance and a bonus of $200 at the successful conclusion of the four-year apprenticeship.

Courses are now maintained for machinists, pattern-makers, and electricians. A large number of the former can be accommodated and relatively few of the latter two. At the present there are 113 machinist apprentices, 9 drafting apprentices, 3 pattern-maker apprentices, and 2 electrical apprentices, 76 of whom are attending, the remainder being either in their probationary period or having completed the school work.

In order to create incentives other than those mentioned, a number of prizes and scholarships have been established. The scholarships are awarded to the best two apprentices and carry with them an annual award of $600 to be spent in the pursuit of an engineering education at any recognized technical school. Two prizes are also awarded to each group per year. One, amounting to approximately $25 worth of tools, is given to the apprentice making the best record in his group and one amounting to approximately $10 worth of tools to the apprentice having made the greatest improvement in his group.

CHEMICAL LABORATORY

DO NOT USE GREASE ON SILENT CHAINS

Grease will not penetrate the joints of the chains, and hence will not lubricate the links properly, resulting in chain breakage and excessive wear. Silent chains have been known to wear out after several weeks service where grease had been used as a lubricant.

A heavy oil should be used for lubricating all chains used on the "Reading." It should be applied with a soft brush or by means of an oil cup that will furnish a constant dripping of oil on the inner surface of the chain. Always put the oil on the inside, or working side of the chain, when the machine is operating at slow speed. In oiling chains from the motor to the Disc Clutch or Handwheel Shaft it is advisable to saturate the chain with a light oil and then cover this with a heavy lubricant, such as 600-W. The light oil will penetrate the joints of the chain and furnish sufficient lubricant to the pins; while the heavy oil will prevent the light oil from being thrown off by centrifugal force.

All chains should be lubricated twice each week; more often if conditions are such that the oil does not remain on the chains for this length of time.

Adjustment of Chains

The chains should always be adjusted with such a tension that the slack side will sag about three-eighths of an inch from a straight line between the bottom edges of the sprockets. This adjustment is important if the maximum service is to be obtained from the chains.

The "READING" RECORD

VOL. 1 — FEBRUARY 1930 — NO. 2

Issued by
TEXTILE MACHINE WORKS, READING, PA.
Henry Janssen, *Pres.* F. Thun, *Sec'y and Treas.*

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CHANGING TREND OF FULL-FASHIONED KNITTING MACHINE GAUGES

A glance at the accompanying chart will show that there has been a constant shifting in gauges during the past twenty-eight years; varying in intensity from time to time, but always toward finer gauges. The years of 1925 and 1926 were banner years for 42-gauge machines, practically 75% of the entire production of "Reading" Machines being of that gauge. However, sales for 1925 still showed a considerable number of 39 gauge machines. There was a decided change in 1927 and a gradual shifting of demand since that time in favor of finer gauges, particularly 45-gauge.

During 1929 less than one-tenth of one per cent of the entire output was 39-gauge, the number being so insignificant that it was eliminated from the statistics. The greater part of the demand was clearly for 45-gauge equipment.

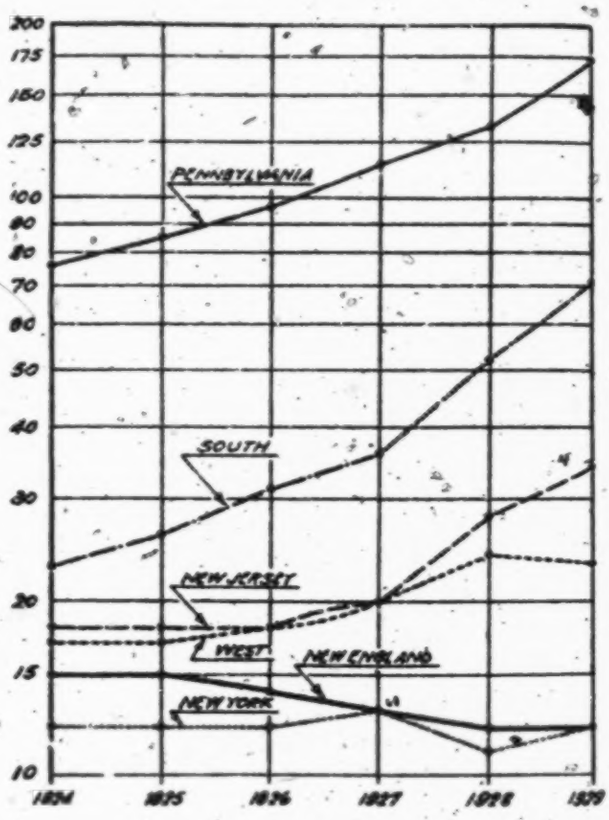
It is our candid opinion, however, that 42-gauge will continue to be popular and that the demand for 45-gauge equipment will not increase in the same proportion that it has during the last few years.

CHART SHOWING THE SHIFTING OF FULL-FASHIONED KNITTING MACHINE GAUGES DURING THE PERIOD OF 1902-29

	33 gauge	36 gauge	39 gauge	42 gauge	45 gauge	48 gauge
1902-1917	6%	10%	75%	9%	..	..
1918	8%	8%	77%	10%	..	
1919	4%	7%	77%	14%	..	
1920	3%	6%	78%	13%	..	
1921	2%	5%	78%	15%	..	
1922	2%	3%	76%	19%	..	
1923	1%	3%	83%	12%	1%	..
1924	1%	3%	84%	11%	1%	..
1925	..	1%	21%	74%	4%	..
1926	..	2%	7%	73%	18%	..
1927	..	..	4%	67%	22%	7%
1928	..	..	2%	38%	28%	14%
1929	..	..	*	41%	33%	6%

*Less than one-tenth of one per cent.

NUMBER OF FULL-FASHIONED STOCKING MILLS IN THE UNITED STATES



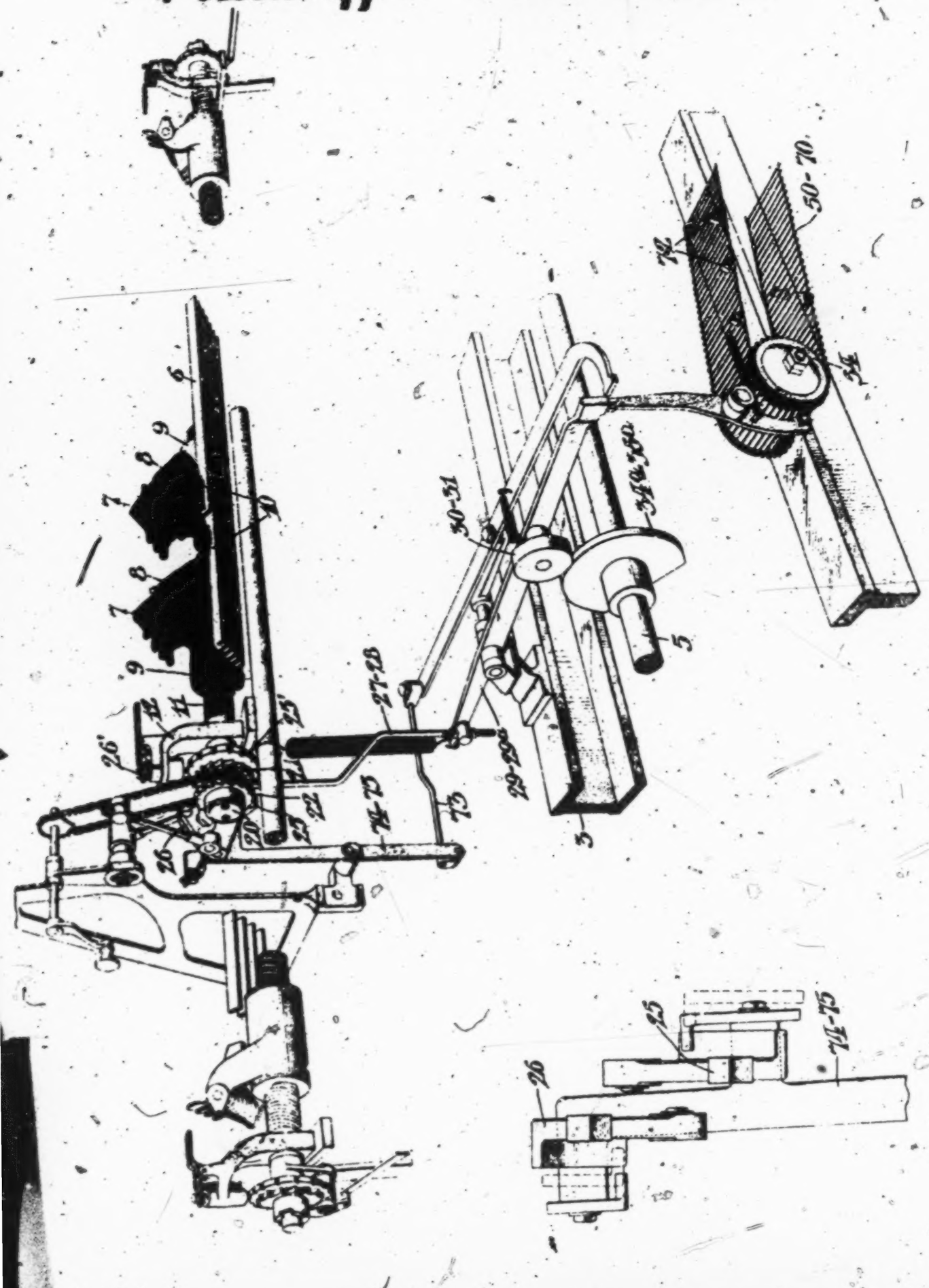
Contrary to general opinion, this chart shows that the development of the industry, as indicated by the number of new mills, is taking place in Pennsylvania and New Jersey at a ratio that is not very much el the increase in the South. In actual number of machines and number of mills, Pennsylvania, New Jersey, and the Western States are still leading. Considering the short period of time since the inception of the industry in the South, the rapid growth in this territory is undoubtedly remarkable.

It is perhaps not generally known that with the present productive capacity of not more than 25 million dozen pairs of full-fashioned stockings per year and with a potential consumption of 40 million dozen pairs there are only approximately 7.44 pairs for each consumer. A recent survey in New York City indicated that the well dressed city girl uses one pair of full-fashioned stockings each week; and a national survey discloses that approximately 5 pairs of full-fashioned and an equal amount of seamless stockings are consumed per person each year. These figures seem to indicate that with a sustained demand for stockings there is as yet no danger of overproduction.

PLAINTIFF'S EXHIBIT NO. 33 532

PLAINTIFF'S EXHIBIT No.

Plaintiff's Attachment



PLAINTIFF'S EXHIBIT No. 34 533 382

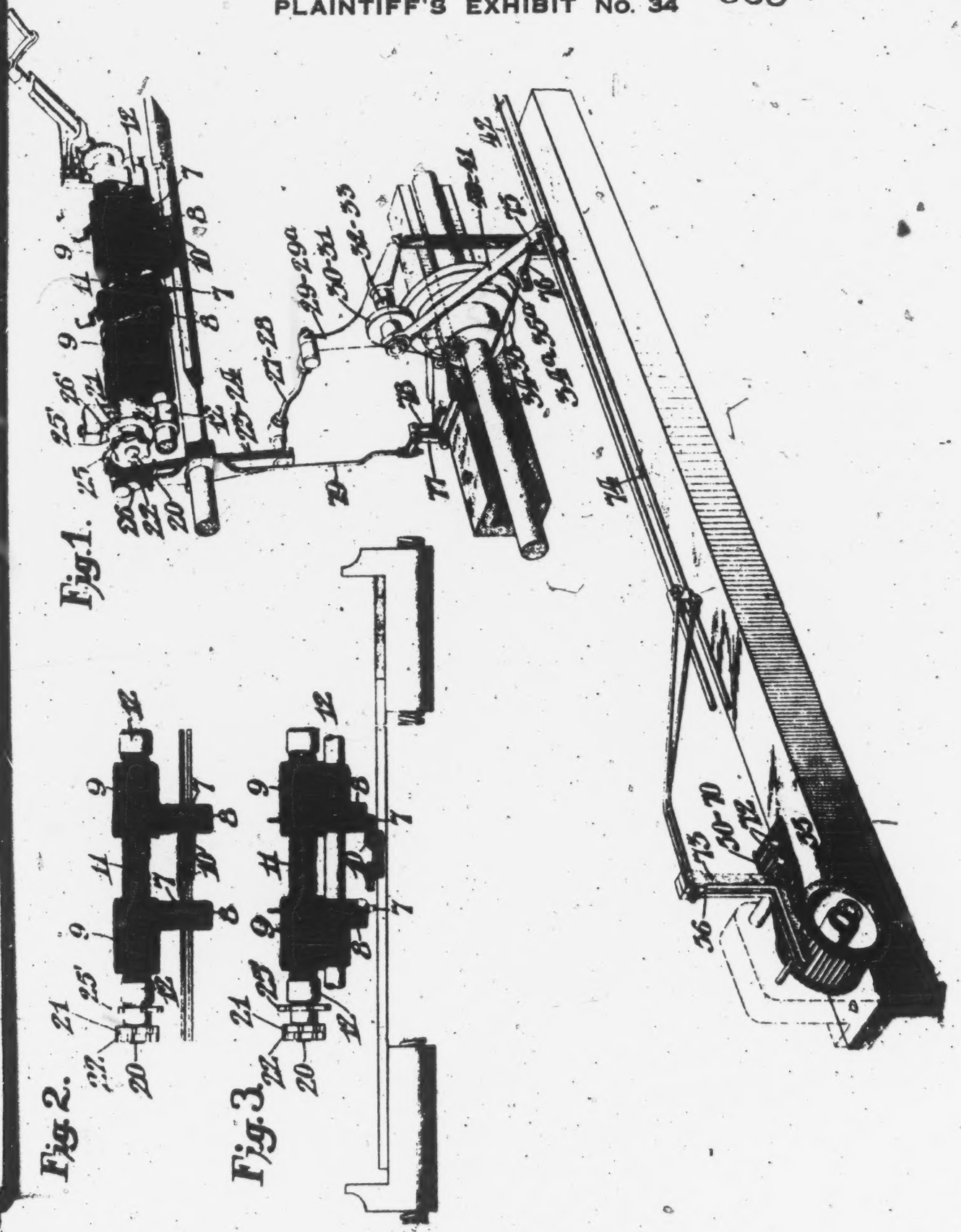


Fig. 1.

Fig. 2.

Fig. 3.

PLAINTIFF'S EXHIBIT No.

Defendant's Attachment

PLAINTIFF'S EXHIBIT No. 35

383
534

PLAINTIFF'S EXHIBIT No.

Attachment on Hofmann Fleetwood Footer No 116811

Page Tightly Bound

[fol. 535] PLAINTIFF'S EXHIBIT No. 36

Number of Schletter Attachments Sold Per Month According to Sales Orders and those Shipped on Machines

1927:

Month	Sales Orders	Machines	Total	Grand Total
August	2	0	2	2
September	0	2	2	4
October	39	14	53	57
November	70	6	76	133
December	62	13	75	208
1928:				
January	86	7	93	301
February	111	7	118	419
March	120	9	129	548
April	115	10	125	673
May	111	5	116	789
June	75	15	90	879
July	52	34	86	965
August	42	66	108	1073
September	46	42	88	1161
October	51	53	104	1265
November	61	51	112	1377
December	56	43	99	1476
1929:				
January	49	48	97	1573
February	84	38	122	1695
March	75	45	110	1805
April	50	64	114	1919
May	68	74	142	2061
June	79	75	154	2215
July	45	71	116	2331
[fol. 536] August	46	111	157	2488
September	89	90	179	2667
October	52	119	171	2838
November	54	122	176	3014
December	59	110	169	3183

Plaintiff's Exhibit No. 36—Continued

1930:

Month	Sales Orders	Machines	Total	Grand Total
January	~~103~~	~~114~~	~~217~~	~~3400~~
February	181	84	265	3665
March	176	75	231	3896
April	186	64	250	4146
May	106	37	143	4289
June	112	30	142	4431
July	107	28	135	4566
August	61	26	87	4653
September	60	31	91	4744
October	53	31	84	4828
November	128	30	158	4986
December	139	28	167	5153
1931:				
January	94	37	131	5284
February	59	26	85	5369
March	79	24	103	5472
April	58	28	86	5558
May	43	34	77	5635
June	28	35	63	5698
July	37	25	62	5760
August	16	30	46	5806
September	20	20	40	5846
October	27	24	51	5897
November	31	28	59	5956
December	10	24	34	5990
1932:				
January	4	26	30	6020
February	4	17	21	6041
[fol. 537] March	8	14	22	6063
April	5	9	14	6077
May	8	8	16	6093
June	6	5	11	6104
July	12	2	14	6118
August	12	2	14	6132
September	12	8	20	6152
October	10	4	14	6166
November	5	13	18	6184
December	23	14	37	6221

Plaintiff's Exhibit No. 36—Continued

1933:

Month	Sales Orders	Machines	Total	Grand Total
January	11	2	13	6234
February	7	2	9	6243
March	5	6	11	6254
April	2	7	9	6263
May	10	3	13	6276
June	3	26	29	6305
July	11	32	43	6348
August	13	29	42	6390
September	10	32	42	6432
October	19	36	55	6487
November	6	35	41	6528
December	7	23	30	6558
1934:				
January	1	14	15	6573
February	3	34	37	6610
March	3	16	19	6629
April	6	9	15	6644
May	4	14	18	6662
June	7	11	18	6680
July	16	2	18	6698
August	8	3	11	6709
September	3	13	16	6725
October	9	18	27	6752
November	9	15	24	6776
December	7	7	14	6790

[fol. 538] PLAINTIFF'S EXHIBIT No. 37

License Agreement

Made and concluded this eighteenth day of September, A. D. 1930, between Textile Machine Works, a corporation created and existing under the laws of the State of Pennsylvania, having its principal office at Wyomissing, Berks County, Pennsylvania, hereinafter designated the Licensor,

and

The Grosser Knitting Machine Co., a firm composed of Robert Winkler and Max Nydegger and having its prin-

cipal office at New York City, State of New York, hereinafter designated Licensee; which firm imports knitting machines and parts manufactured by the firm of G. Hilscher, of Chemnitz, Germany, and is attorney in fact for the said G. Hilscher Co.,

Witnesseth:

Whereas, Letters Patent of the United States Nos. 1,713,628 and 1,752,206 for Attachments for Flat Knitting Machines were granted to Richard E. Schletter May 21, 1929, and March 25, 1930 respectively, and were subsequently assigned to the Licensor under date of December 20, 1929, as duly recorded in the United States Patent Office, Liber C 142 page 74, and

Whereas, the Licensee is desirous of obtaining a license, non-exclusive, non-assignable, to import, manufacture and sell throughout the United States of America and the terri- [fol. 539] tories thereof, knitting machine attachments embodying and employing the inventions of the aforesaid Patents.

Now, Therefore, the Parties Have Agreed as Follows:

1. Subject to the due performance of all the terms, covenants, and conditions of this agreement on the part of the Licensee agreed to be performed hereunder, the Licensor has given and granted, and by these presents does give and grant unto the Licensee, upon the terms and conditions and with the limitations herein set forth, for the remainder of the term of the aforesaid United States Patents, a non-exclusive and non-assignable right to import, manufacture and sell, throughout the United States of America and its territorial possessions, knitting machine attachments embodying and employing the inventions set forth and claimed by claims one to eight and fourteen to eighteen inclusive of the aforesaid Patent No. 1,713,628, and all the claims of Patent No. 1,752,206, unless this agreement is sooner terminated as herein provided. Accordingly, the Licensee will be free to import, make and sell knitting machine attachments as covered by the recited claims of said Patents, and incorporating mechanism for producing a split seam in knitted fabric as shown by the sample attached at the end of this agreement and marked Exhibit A; but will not be at liberty to make such attachments incorporating mechanism covered by claims nine to

thirteen, and nineteen to twenty-three inclusive, of Patent No. 1,713,628, for producing a split seam in knitted fabrics [fol. 540] as illustrated by the sample attached at the end of this agreement and marked Exhibit B.

2. The Licensee agrees to pay to the Licensor, as a license fee, seventy-five dollars ($75) upon each attachment in accordance with the recited claims, sold in the United States by the Licensee, subsequent to May 21, 1929, or previously sold, and since then in use.

3. The Licensee, within fifteen (15) days after the first days of January, April, July, and October, in each and every year, during the continuance of this agreement, agrees to furnish to the Licensor written statements, under oath, specifying the total number of attachments embodying and containing the said inventions sold by the Licensee during the preceding quarter, such statements to be accompanied by a check in payment of the royalty for the period covered thereby. The first statement shall be rendered not later than the fifteenth day of October, 1930, and shall cover the attachments embodying the inventions, sold by the Licensee, or in use by its customers, since May 21, 1929, and to October 1, 1930.

4. The Licensee agrees to mark all attachments put out under this license as follows: Patents No. 1,713,628—1,752,206.

5. The Licensee admits the validity of said Patents Nos. 1,713,628 and 1,752,206, and agrees not to dispute the validity thereof or the title of the Licensor thereto, and further agrees that it will not contest the same directly or indirectly, [fol. 541] in any way whatsoever, or aid others in doing so.

6. If the Licensee shall at any time make default in the payment of any royalty or the making of any report hereunder or shall commit any breach of any covenant or agreement herein contained, or shall make false report and shall fail to remedy any such fault or breach within fifteen days after written notice thereto by the Licensor, the Licensor may, at its option, cancel this agreement and revoke the license herein granted by a notice in writing to such effect, and such act shall not prejudice the right of the Licensor to recover any royalties or other sums due at the time of

such cancellation and shall not prejudice any cause of action or claim of the Licensor accrued or to accrue, on account of any breach or default made by the Licensee.

7. The Licensee agrees to keep full, accurate and complete books of account, records, data or memoranda respecting the said business, and showing the number of attachments imported, manufactured and sold under the license herein granted in sufficient detail to enable the royalties payable hereunder by the Licensee to be determined, and further agrees to and does hereby give to a certified public accountant or accountants of the State of New York designated by the Licensor, the privilege of examining its said books and records at all reasonable times and from time to time for the purpose of verifying the reports provided for in article No. 3 hereto. The said accountant may communicate to the Licensor the result of its investigation, [fol. 542] and except as hereinafter provided, said accountant shall not copy customers names of the Licensee, however, in any instance or instances, where the Licensor is desirous of checking the sales to a particular customer or customers of the Licensee, for the purpose of verifying the Licensee's report, the accountant may copy the name or names of the particular customer or customers, and communicate the details thereof to the Licensor.

8. If the Licensee shall become insolvent, or shall make an assignment for the benefit of creditors, or proceedings in voluntary or involuntary bankruptcy shall be instituted in behalf of or against the Licensee, or a receiver or trustee of the Licensee's property shall be appointed, the license herein granted shall terminate forthwith, but the Licensor shall recover royalties on imported, manufactured and unsold attachments, and in case of any such termination, the right, title or interest in and to the license covered by this agreement shall then and thereby forthwith revert to and become vested in the Licensor.

9. Any notice which the Licensor may serve under this agreement may be served by enclosing the same in a post paid wrapper, addressed to the Licensee, or its receiver or trustee in bankruptcy, at its or their last known address, and depositing the same by registered mail in any Post Office.

10. The Licensor shall have the sole and exclusive right to institute and prosecute any and all suits and enjoin any and all infringement of said Patents; and from time to time [fol. 543] during the continuance of this agreement, may institute any suit or suits which it may deem necessary; the Licensor will have the sole right to institute and prosecute such suits, and to employ therefor its own counsel, and it shall pay for the services rendered by counsel so retained, and all costs and expenses incidental thereto.

11. It is understood and agreed that if any suit or suits be brought against the Licensee for infringement of a patent covering the inventions set forth by claims one to eight and fourteen to eighteen inclusive of Letters Patent No. 1,713,628, or all the claims of Patent No. 1,752,206, that the Licensor will prosecute such suit or suits in defense of the Licensee, employing therefor its own counsel, and it shall pay for the services rendered by counsel so retained, and all costs and expenses incidental to such suit or suits.

12. It is to be understood that the Licensor assumes no responsibility whatsoever for any law suit or suits brought against the Licensee or its customers for infringement of any design or other patent which covers the product produced by the attachments of this agreement.

13. This agreement shall be binding upon and enure to the benefit of the successors or assigns of the Licensor; also, it shall be binding upon and enure to the benefit of the successors of the entire business of the Licensee, but the Licensee may not assign the same.

IN WITNESS WHEREOF, the parties hereto have caused these presents to be signed and sealed, the day and year first above written.

TEXTILE MACHINE WORKS

BY: Henry Janssen

ATTEST:

President, Licensor

Secretary

GROSSER KNITTING MACHINE CO.
Acting also as attorney in fact for G. Hilscher

BY:

ATTEST:

Secretary

EXHIBIT A

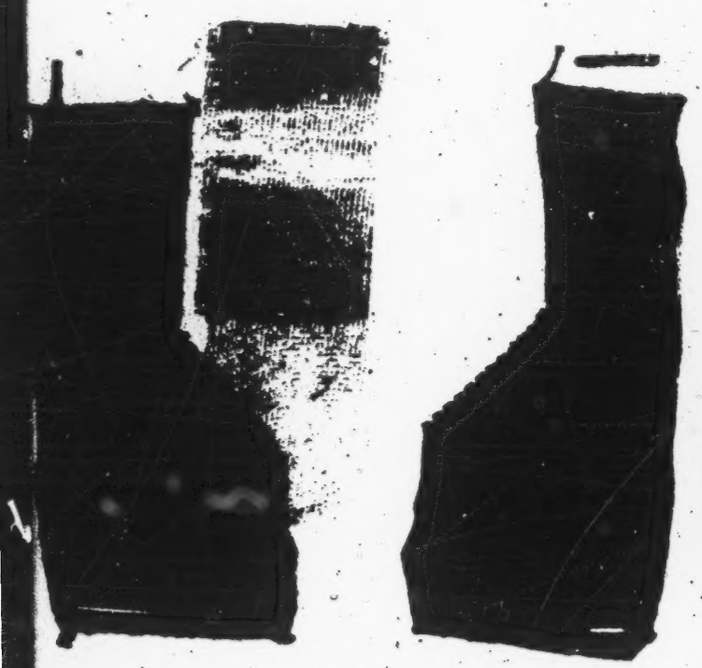
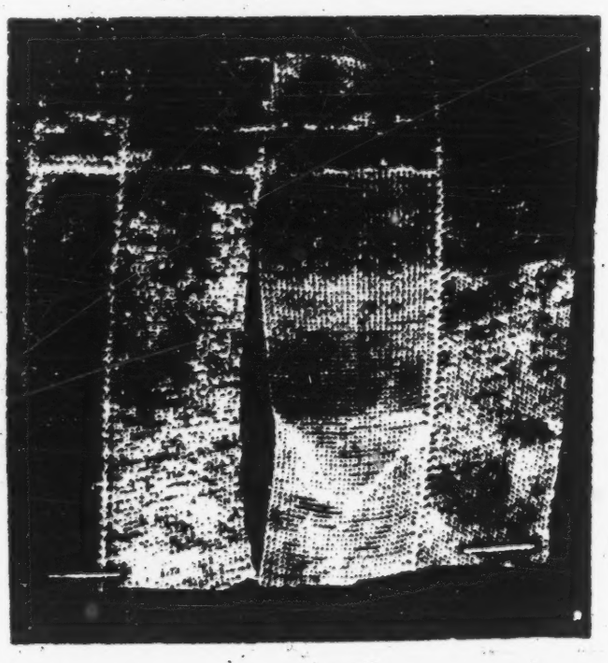


EXHIBIT D



[fols. 545-551] PLAINTIFF'S EXHIBIT No. 39

March 31, 1925. 1,531,349.

R. E. SCHLETTER

FULL FASHIONED CLOCKED HOSIERY AND METHOD OF MAKING SAME

Filed Jan. 6, 1923 3 Sheets-Sheet 1

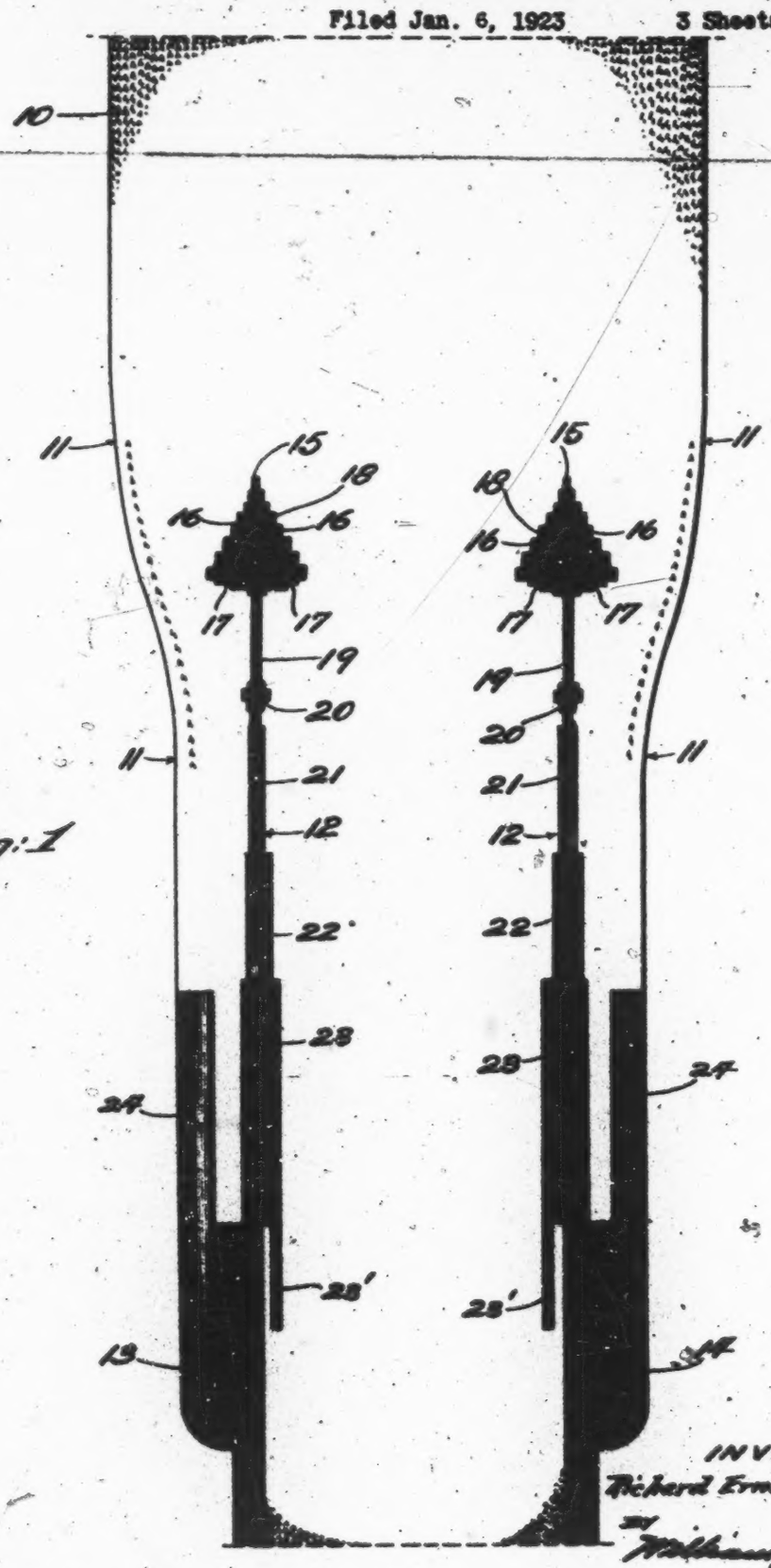


Fig. 1

INVENTOR
Richard Ernest Schletter
By William J. Gra...
ATTORNEY

395

March 31, 1925. 1,531,349

R. E. SCHLETTER

FULL FASHIONED CLOCKED HOSIERY AND METHOD OF MAKING SAME

Filed Jan. 6, 1923 3 Sheets-Sheet 2

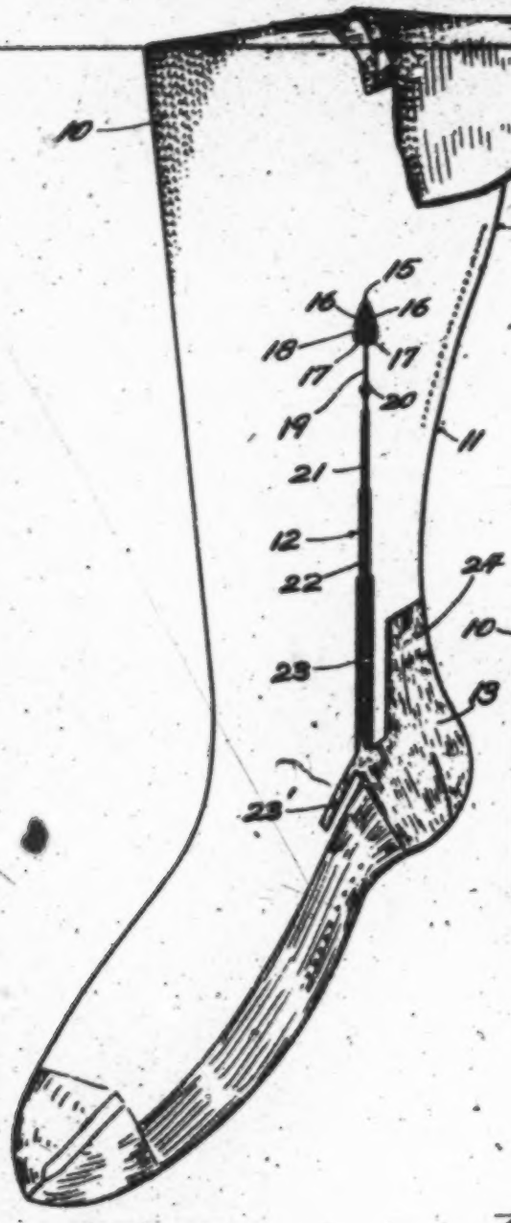


Fig. 2

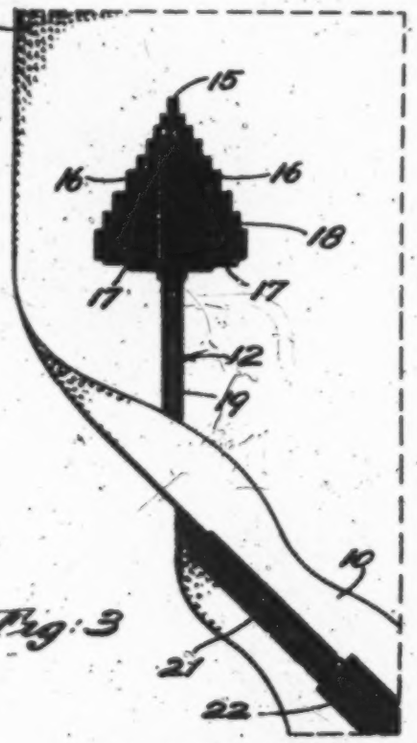


Fig. 3

INVENTOR.
Richard Ernst Schletter.
BY William J. Clarke
ATTORNEY.

396

March 31, 1925. 1,531,349

R. E. SCHLETTER

FULL FASHIONED CLOCKED HOSIERY AND METHOD OF MAKING SAME

Filed Jan. 6, 1923 3 Sheets-Sheet 3

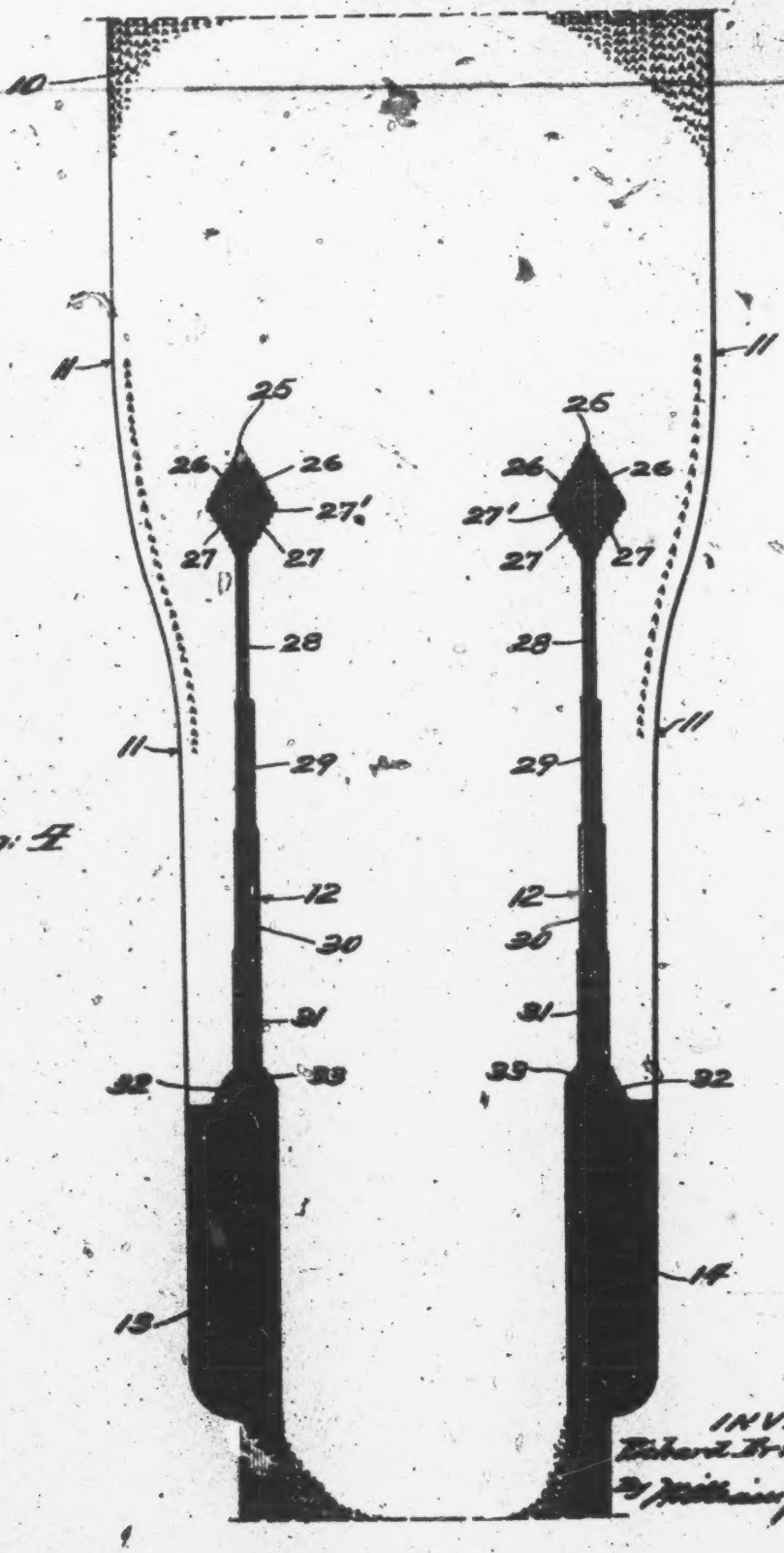


Fig. 1

INVENTOR.
Richard Ernst Schletter.
By William J. Jackson
ATTORNEY.

Patented Mar. 31, 1925. 1,531,349

UNITED STATES PATENT OFFICE.

RICHARD ERNST SCHLEITER, OF PHILADELPHIA, PENNSYLVANIA.

FULL-FASHIONED CLOCKED HOSIERY AND METHOD OF MAKING SAME.

Application filed January 4, 1922. Serial No. 527,158.

To all whom it may concern:

Be it known that I, RICHARD ERNST SCHLEITER, a citizen of the Republic of Germany (naturalization papers applied for), residing at the city of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improved Full-Fashioned Clocked Hosiery and Methods of Making Same, of which the following is a specification.

This invention, generally stated, has relation to hosiery of full fashioned type and has more particular relation to fashioning clocks thereon.

Commercially considered, two types of clocked hosiery are in use. In one type clocks are of open work, termed clock-lace, and stockings of this type being relatively fragile are not suited for all occasions or every-day use and furthermore are comparatively expensive. The other type comprises hosiery in which clocks are embroidered thereon. While this type is best suited for every-day use practice dictates, that the action of needles laying-on the embroidery yarn serves to so weaken the stocking-web as to have a deleterious effect thereon. The embroidering operation also serves to increase manufacturing costs.

The leading object of the present invention is to overcome the above described, disadvantageous features and provide full fashioned hosiery with clocks knitted in with the stocking-web by means of re-inforcing thread, whereby, not only is the stocking-web adjacent said clocks strengthened and the cost of production reduced, thus providing hosiery suitable for every-day use, but, in addition, hosiery is provided possessed of unique, structural characteristics presenting an ornamental and distinctive appearance, rendering such hosiery suitable for wear upon special occasions also. A further object of the present invention is to provide fine, chiffon silk hosiery with clocks in such manner, that, while the ankle portion thereof is re-inforced by such clocks the latter are not detrimental to the appearance of the stocking, but, upon the contrary enhance its appearance. A still further object of the present invention is to knit into the ankle portion of a stocking-web, simultaneously with the formation of clocks, re-inforcing thread in alignment with the heel-parts but spaced from the clocks whereby a re-inforced, rear ankle portion is provided above the heel of a stocking.

With these and other objects in view, the invention consists of the improvements hereinafter described and finally claimed.

The nature, characteristic features and scope of the invention will be more fully understood from the following description, taken in connection with the accompanying drawings forming part hereof, and in which:—

Fig. 1, is a fragmentary view of a stocking-web fabricated in accordance with the present invention.

Fig. 2, is a view in side elevation of a completed stocking.

Fig. 3, is a fragmentary view of a stocking-web exposing both sides of a clock, and

Fig. 4, is a fragmentary view of another form of stocking-web fabricated in accordance with the present invention.

For the purpose of illustrating my invention I have shown in the accompanying drawings two forms thereof which are at present preferred by me, since the same have been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of the instrumentalities as herein shown and described.

The web of hosiery embodying features of the present invention is knit upon a straight knitting machine equipped with mechanism capable of co-acting with respect to the web-forming needles to provide re-inforcements having zig-zag-like lines inclined to the wales and courses of the web. An example of such stocking re-inforcement is disclosed in Letters Patent granted to me under date of September 19, 1916, and numbered 1,198,482. In manufacture, the stocking-web, which has selvage edges, is knit in a well understood manner to that portion of the leg at which the narrowing operation takes place. In the drawings the stocking-web is designated 10 and the narrowing leg portion is designated 11—11. At or about the time narrowing of the leg portion is commenced, additional or re-inforcing thread is presented to certain of the web-forming needles to effect formation of a clock or clocks 12. During formation

of a clock or clocks it is to be understood, that, fabrication of the stocking-web, including the re-inforced heel portions 13—14, takes place in the usual and well understood manner of making full fashioned hosiery. The additional or re-inforcing thread is supplied to the web-forming needles so that zig-zag-like lines inclined to the wales and courses of the web are produced to effect the contour of a clock or clocks. Obviously, depending upon the contour of a clock or clocks desired, the feeding of additional thread varies. It is to be understood also, that, the clock or clocks may extend above or below the parts 11—11 of the web. In practice I commence the formation of the clock or clocks midway of the narrowing portion of the web. Obviously but one clock may be formed upon a stocking-web if desired, although in practice two are provided. As the steps of formation of two clocks are mere duplication the following description, for illustrative purposes, will be restricted to the fabrication of single clocked stocking-web.

Referring now more particularly to the form shown in Figs. 1, 2 and 3, a description of the method of formation will now be given. At or about the time the narrowing of the stocking-web 10 takes place one or more of the web-forming needles are provided with additional or re-inforcing thread to form the top 15 of a clock. At predetermined intervals, thereafter, additional needles have fed thereto said thread to provide a re-inforced portion of gradually increasing width the outline or contour of which is comprised of zig-zag-like lines 16—16. The re-inforcing thread at predetermined intervals is now withheld from the stocking-web forming needles to form the lines 17—17 thus completing a conventional, leaf-like figure 18. From the bottom of this figure 18 there is extended downwardly, in a vertical manner, a portion 19 formed by one or more web-forming needles knitting re-enforcing thread into the web 10. At a predetermined place said portion 19 may have added thereto a small design, as a cross 20, formed by supplying, at predetermined intervals, additional needles with re-inforcing thread and then withholding said thread at similar intervals. Upon completion of portion 19, additional needles are provided with re-inforcing thread to provide widened part 21. At a predetermined place part 21 is also widened to provide part 22 which latter part, in turn, is widened at a predetermined place to provide part 23 which extends down to a heel part. The combined parts 18, 21, 22 and 23 form a vertical, stem-like figure gradually increasing in width upon each side of a medial line extending vertically therethrough. The outline or contour of such stem-like figure is formed by zig-zag-like lines although not as pronounced as in the leaf-shaped figure. At or about the time that the formation of part 23 is commenced a group of web-forming needles spaced from those forming a clock, are provided with re-inforcing thread and knit into the web, simultaneously with the formation of the balance of part 23, a re-inforced part 24 which extends laterally from a selvage edge of the stocking-web toward a clock. The part 24 is at the rear of the ankle, is above the heel and in alignment therewith and is spaced from a clock. This part 24 is positioned to resist wear at or near the heel in the rear thereof. This provides a useful adjunct to a stocking, is not detrimental to its appearance because it blends with the particular type of clocks employed and is inexpensive in that it may be fabricated simultaneously with a clock. Upon completion of part 23 of the clock and the part 24 at the stocking rear, the clock is finished by withholding re-inforcing thread from certain of the needles and permitting others to knit re-inforcing thread in a direction toward the stocking toe for a pre-determined distance as indicated at 23'. This part is spaced from the re-inforced foot portion and forms a finish for the lower portion of a clock. Simultaneously with the formation of part 23', certain of the needles which have formed clock part 23 and heel part 24 and those needles forming the part there-between are supplied with re-inforcing thread to effect formation of a conventional re-inforced heel part. A conventional foot is then attached to the stocking-web in the usual manner.

A description will now be given of the formation of a stocking-web as disclosed in Fig. 4. At or about the time the narrowing of the stocking-web takes place one or more of the web-forming needles are provided with additional or re-inforcing thread to form the top 25 of a clock. At predetermined intervals, thereafter, additional needles have fed thereto said thread thus providing a re-inforced portion of gradually increasing width the outline or contour of which is comprised of zig-zag-like lines 26—26. The re-inforcing thread, at predetermined intervals, is now held free of certain of the web-forming needles thus providing a re-inforced portion of gradually decreasing width, the outline or contour of which is comprised of zig-zag-like lines 27—27. Thus a relatively diamond-shaped figure 27' is produced. From the bottom of this figure 27' there is extended downwardly, in a vertical manner, a portion 28 formed by one or more web-forming needles being supplied with re-inforcing thread. At a predetermined place such part 28 may be widened as at 29 by supplying additional needles, at least one upon each side of the

group which has formed part 32, with re-inforcing thread. At a predetermined place part 29 may be also widened for a machine similar to that above described, to form part 33. This part 29 may in turn, at a predetermined place, be also widened for a desired distance to form part 31. The combined parts 29 to 31 inclusive form a vertical, stem-like figure gradually decreasing in width upon each side of a medial line extending vertically therethrough. The outline or contour of such stem-like figure is formed by zig-zag-like lines although not as pronounced as in the diamond shaped figure 27. The stem-like portion above described is now appreciably widened along zig-zag-like lines 32—33 by supplying additional web-forming needles with the re-inforcing thread. The above described, re-inforced part forms a clock spaced from the selvage edge of the web. The zig-zag like line 32 is carried further down the ankle-portion of the web than is the line 33 and at a predetermined place all of the web-forming needles between a selvage edge and a clock are supplied with additional thread to provide a re-inforced heel part. The stocking is now finished in the usual manner it being understood that the heel re-inforcement is a continuation of the clock as fabricated.

The above described methods of fabrication provide neat, attractive and comparatively inexpensive hosiery. Further fine chiffon silk may be employed because the clocks, being formed simultaneously with and knitted directly into the stocking-web, act as re-inforced parts and provide for stability. A clocked stocking-web as above described and formed, is a reversible fabric, the clocks appearing upon opposite faces of a web as clearly shown in Fig. 3. While the above description and drawings have been restricted to two designs of clocks, for illustrative purposes, it will be understood that varied styles of clocks may be effected by providing various combinations of web-forming needles with additional or re-inforcing thread.

Clocked hosiery as above described may be fashioned from silk or other thread, for instance white silk, and then "dipped" for instance in black dye to provide a stocking in which the web and clock are of the same color. In case it is desired to have a stocking-web and clock of contrasting colors the same may be accomplished either according to "dipping" procedure or to "ingrain" system of formation. In the former case, assuming for the purpose of illustration that a green clock is desired upon a black stocking, the web is knit from undyed silk or other thread as usual, but, the re-inforcing thread, as introduced to form a clock, has been colored green with specially prepared dye to resist accepting dye of any other color. Thus when the completed stocking-web is treated with black dye, the green thread from the needles that knit the clock retains its original color, the rest of the stocking-web and the thread which knits the heel and toe portions being dyed black. Instead of using green thread for the clock and black thread for the stocking-web, any other contrasting colors may be employed. For example, if it is desired to have a white stocking-web with a colored clock obviously it is only necessary to dye the re-inforcing thread previous to introduction to the web-forming needles.

In practice a flat knitting machine is provided with an attachment for operating at predetermined intervals those thread carriers upon the machine which supply the web-forming needles with re-inforcing thread.

It will now be apparent that I have devised novel and useful constructions which embody the features of advantage enumerated as desirable in the statement of the invention and the above description, and while I have in the present instance shown and described the preferred embodiments thereof which have been found in practice to give satisfactory and reliable results, it is to be understood that the same are susceptible of modification in various particulars without departing from the spirit or scope of the invention or sacrificing any of its advantages.

What I claim is:—

1. The herein described method of manufacturing full fashioned clocked hosiery which consists in knitting directly into the stocking-web in spaced relation from the opposite edges thereof; and simultaneously with formation of said stocking web re-inforcing thread in successive clock-forming courses, said courses defining zig-zag-like lines substantially inclined to the wales and courses of said web and continuing knitting of re-inforcing thread to form re-inforced heel-portions which are continuations in part of said clocks.

2. The herein described method of manufacturing full fashioned clocked hosiery which consists in knitting a stocking-web until the usual narrowing operation takes place, substantially at which time re-inforcing thread is provided selected web-forming needles spaced from the opposite edges of the web for introducing the re-inforcing thread into the web in successive clock forming courses, the opposed ends of the courses defining zig-zag-like lines substantially inclined to the wales and courses of said web, which operation continues until the heel portion of the web is reached at which time re-inforcing thread is provided additional needles to form re-inforced heel-portions

which are continuations in part of said clocks.

3. The herein described method of manufacturing full fashioned clocked hosiery which consists in knitting directly into the stocking-web in spaced relation from the opposite edges thereof, and simultaneously with formation of said stocking-web, the opposed ends of which comprise edges of said web, [illegible] and courses of said web and clocking having [illegible] and positions spaced from the [illegible] and terminating in parts of said clocks and re-inforced [illegible] positions.

4. As a new article of manufacture, a full fashioned clocked stocking, the opposed clocks being formed of uncompressed courses of re-inforcing thread knitted directly into the stocking-web in spaced relation from the stocking-toe seam; and simultaneously with formation of said stocking-web, the opposed ends of which comprise edges of said web, [illegible] and courses of said web and clocking having [illegible] and positions spaced from the [illegible] and terminating in parts of said clocks and re-inforced [illegible] positions.

In testimony whereof, I have hereunto signed my name.

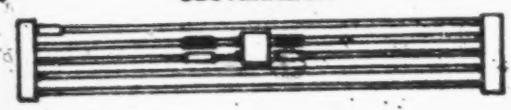
RICHARD ERNST SCHLETTER.

PLAINTIFF'S EXHIBIT No. 48 552

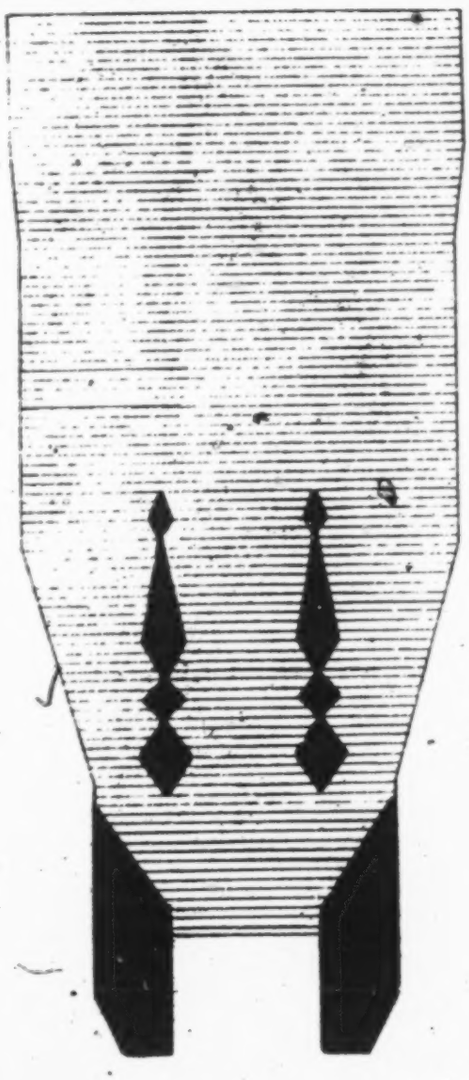
PLAINTIFF'S EXHIBIT NO.

BLANK WITH 2 SHADOW CLOCKS & HEELSTEPS

OESTERREICH



SCHLETTER



554

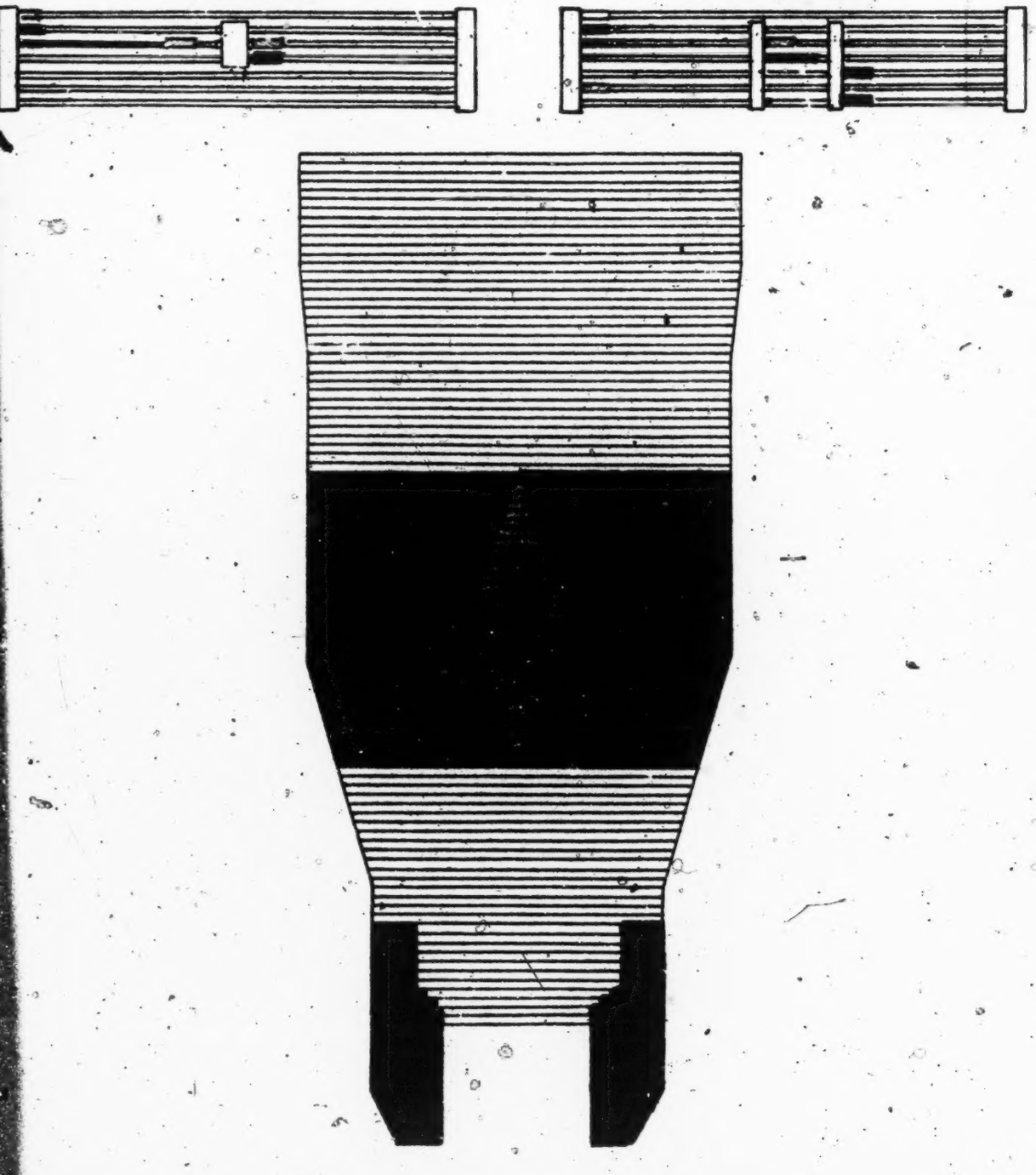
PLAINTIFF'S EXHIBIT No. 50

PLAINTIFF'S EXHIBIT NO.

BLANK WITH 1 INSERT, 1 SHADOW CLOCK & HEELSTEPS

OESTERREICH

SCHLETTER



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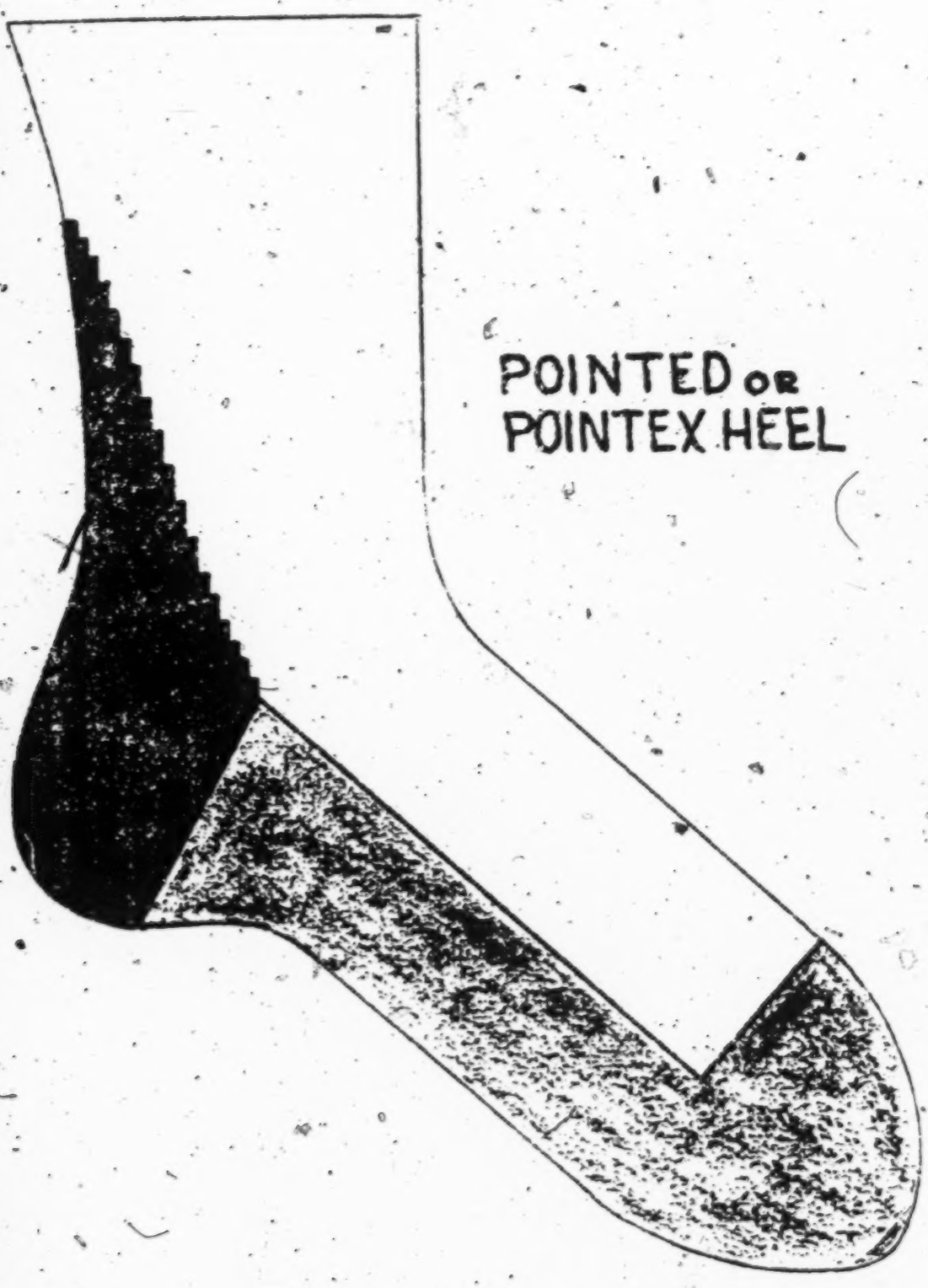

[fols. 556-557] PLAINTIFF'S EXHIBIT No. 53.

2 Needle Closed Split Attachment as sold by: Textile Machine Works, Reading, Penna.

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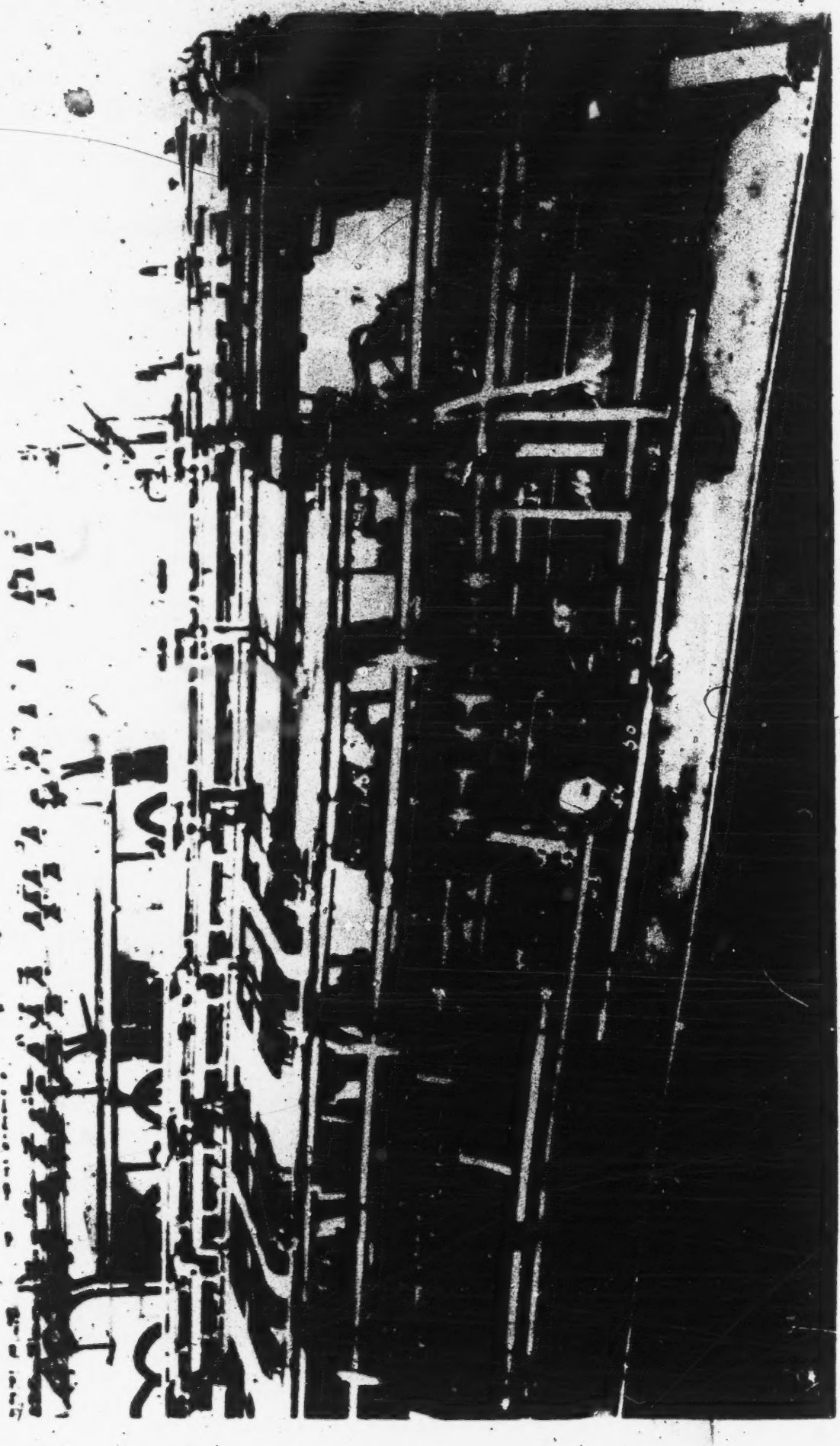
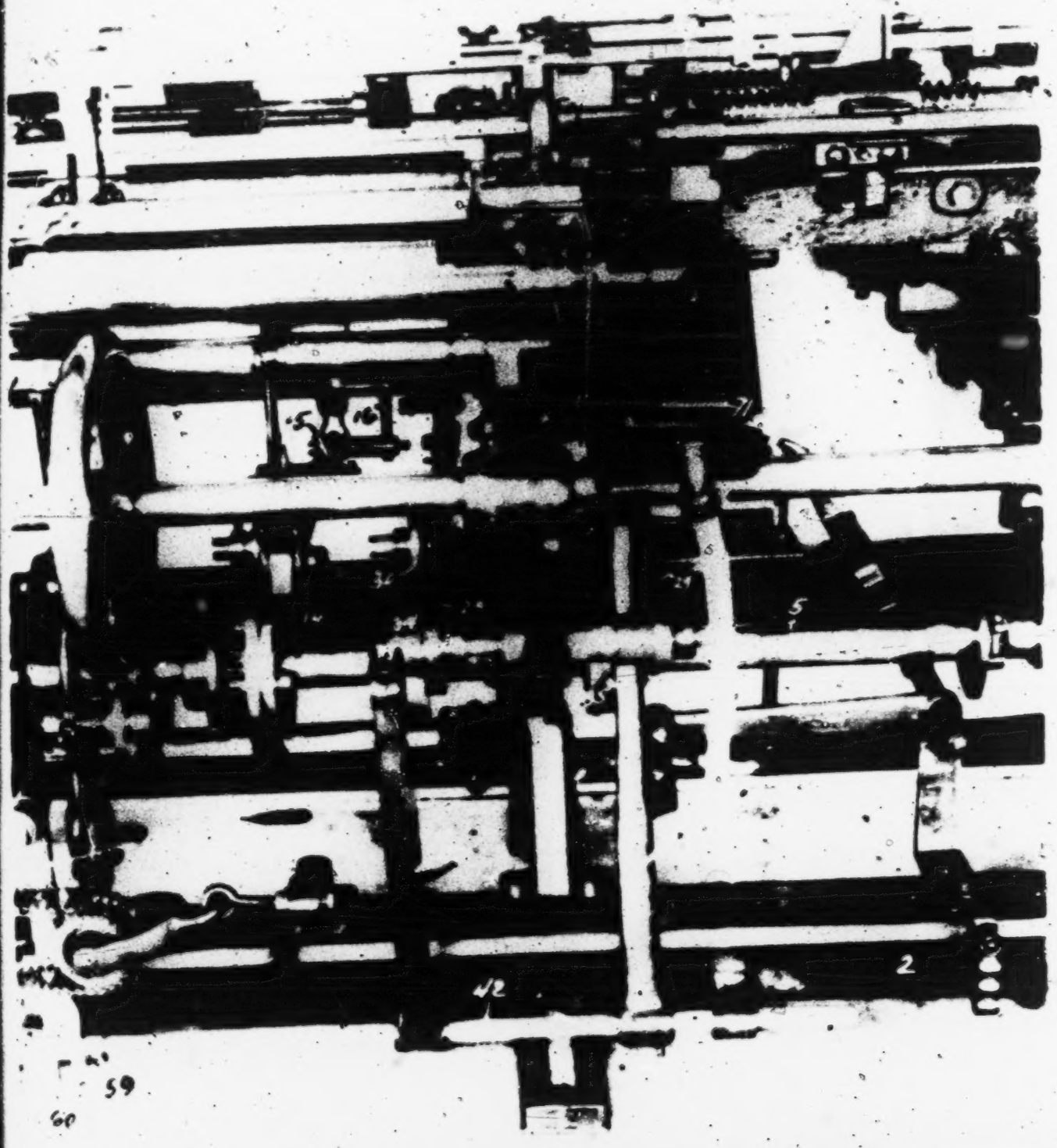
	1932	29	
	1933	65	
	1934	39	
	1935	29	
			179
Sold as per Sales Orders combined with Reinforced Selvedge Attachment	1931	127	
	1932	61	
	1933	46	
	1934	10	
	1935	9	
			253
Sold as per Sales Orders for old machines equipped with Reinforced Selv. Att.	1931	99	
	1932	8	
	1933	0	
	1934	3	
			110
Total			542

Oct. 11th. 1935.
GB/Bo.

[fols. 558-562] PLAINTIFF'S EXHIBIT NO. 54

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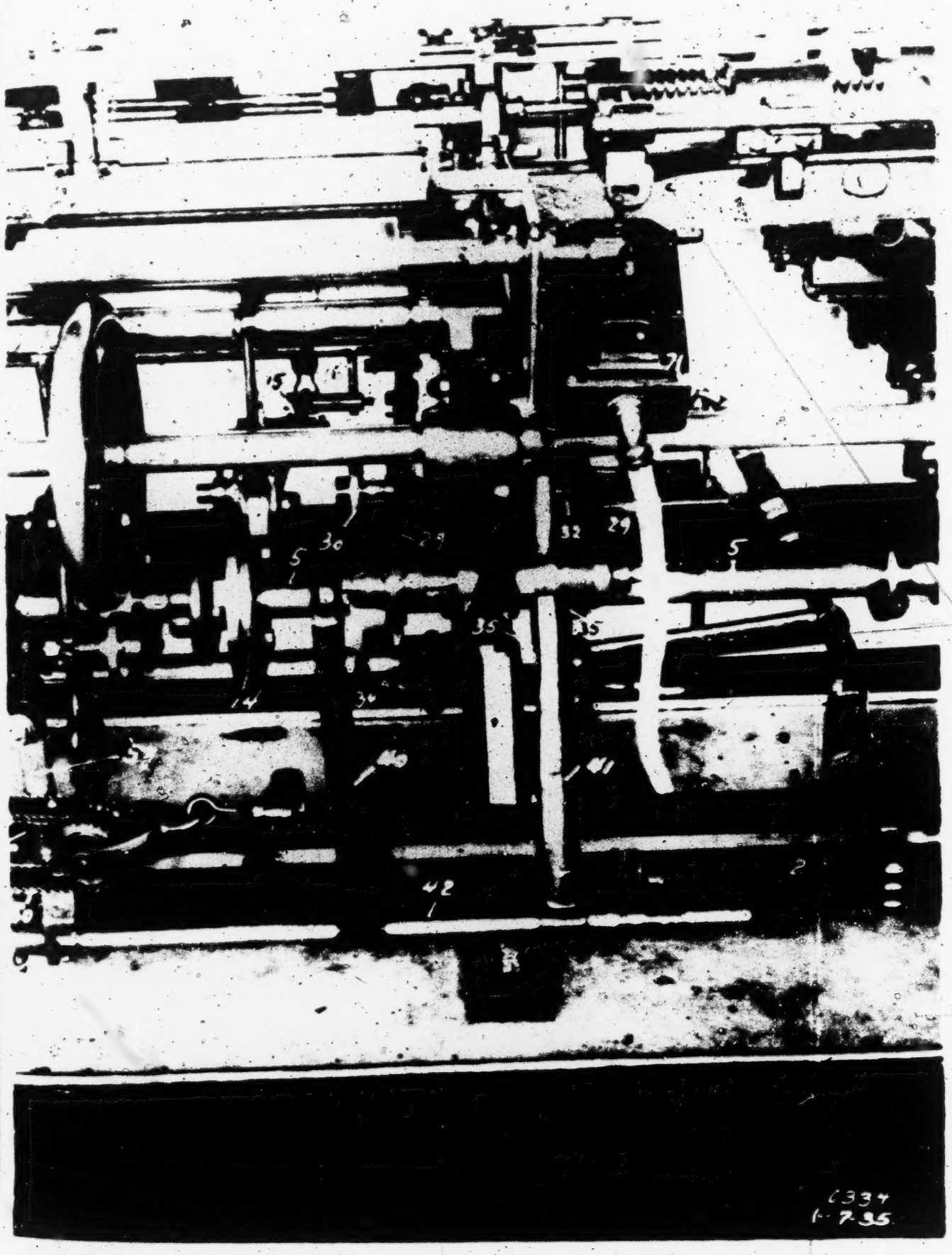
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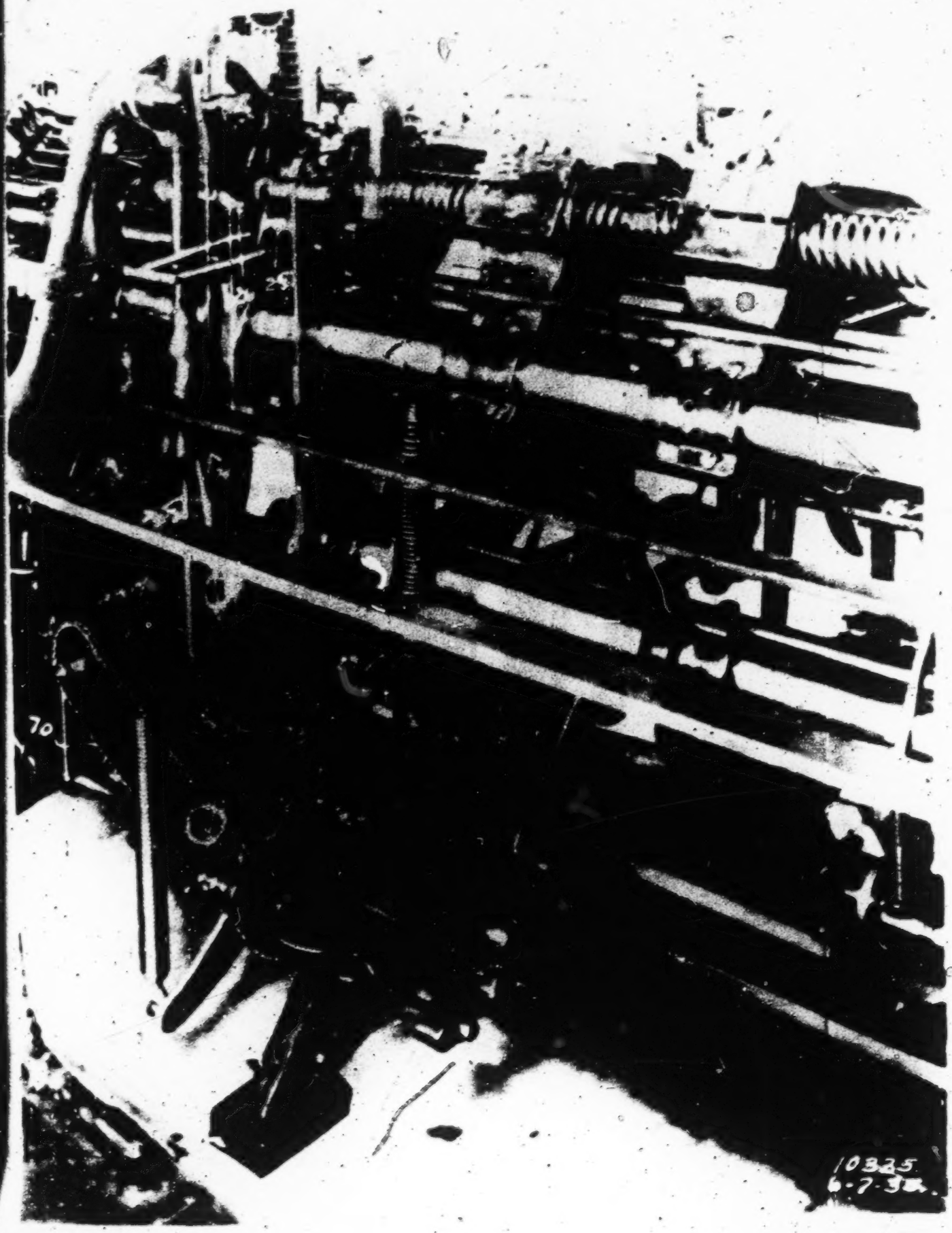
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413

F. CECKA.

APPARATUS FOR MAKING REINFORCED KNITTED GOODS.

APPLICATION FILED JULY 22, 1914.

1,213,333.

Patented Jan. 23, 1917.

3 SHEETS—SHEET 1.

Fig. 1.

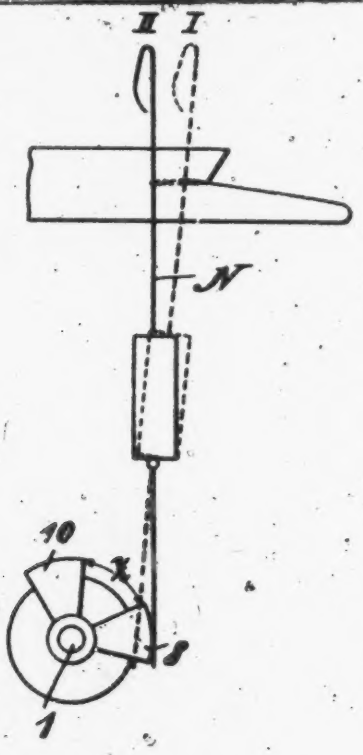


Fig. 2.

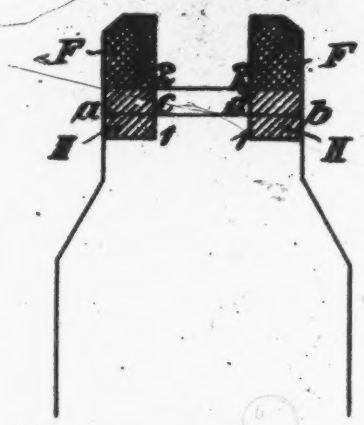


Fig. 3.

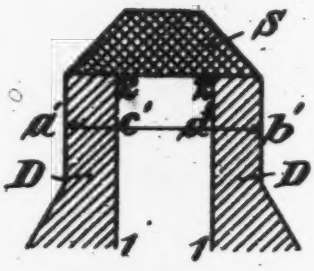


Fig. 4.

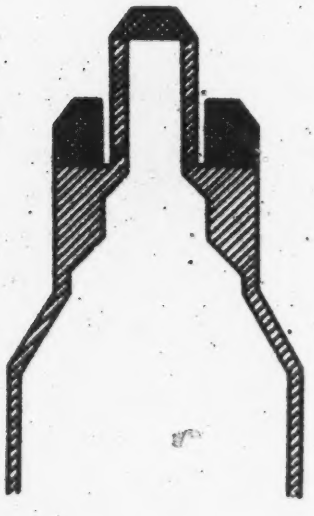
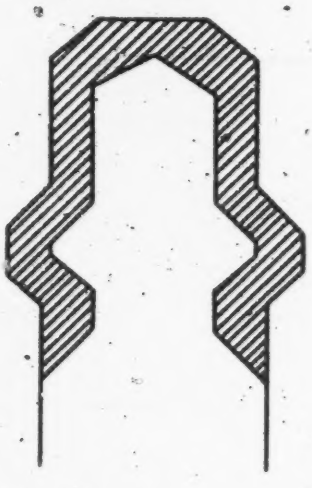


Fig. 5.



Witnesses:
B. Dommers
C. Lecier

Inventor
Franz Cecka.
By Henry Orth & Co. Attys

414

F. CECKA.

APPARATUS FOR MAKING REINFORCED KNITTED GOODS.

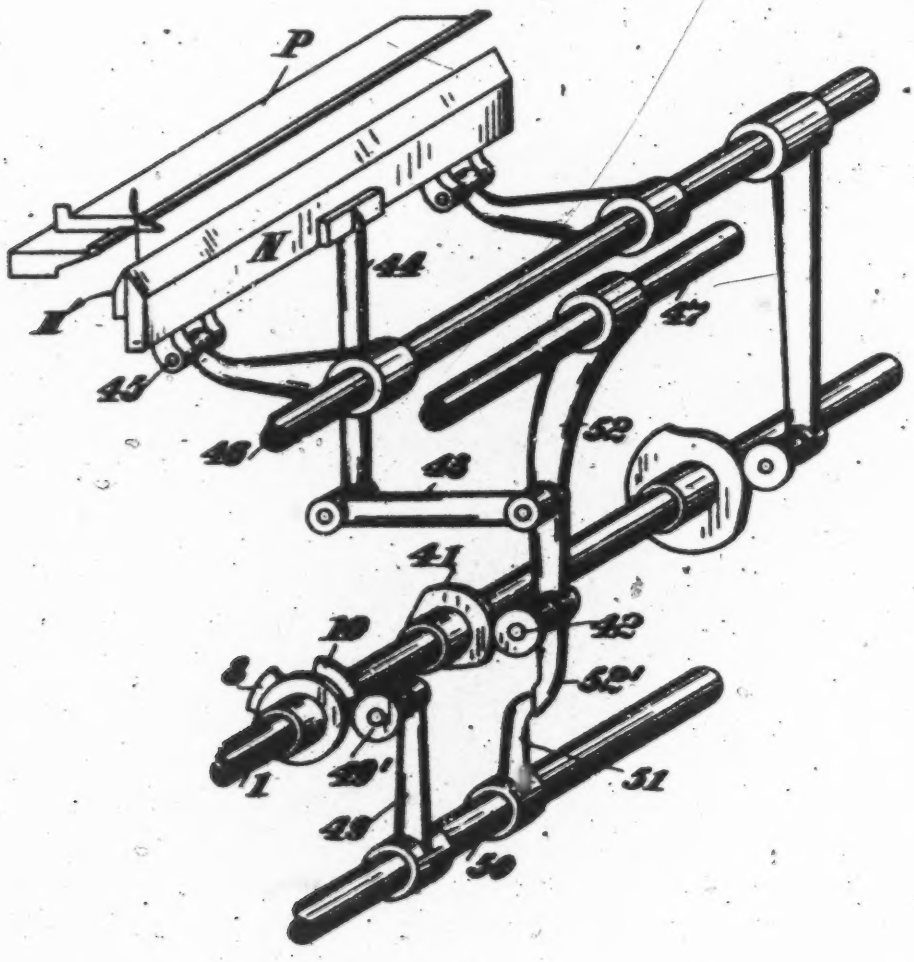
APPLICATION FILED JULY 22, 1914.

1,213,333.

Patented Jan. 23, 1917.

3 SHEETS—SHEET 2.

Fig. 1a



Inventor.
Franz Cecka.
By Lewis and Lewis Attys.

415

F. CECKA.

APPARATUS FOR MAKING REINFORCED KNITTED GOODS.

APPLICATION FILED JULY 22, 1914.

1,213,333.

Patented Jan. 23, 1917.

3 SHEETS—SHEET 3.

Fig: 6.

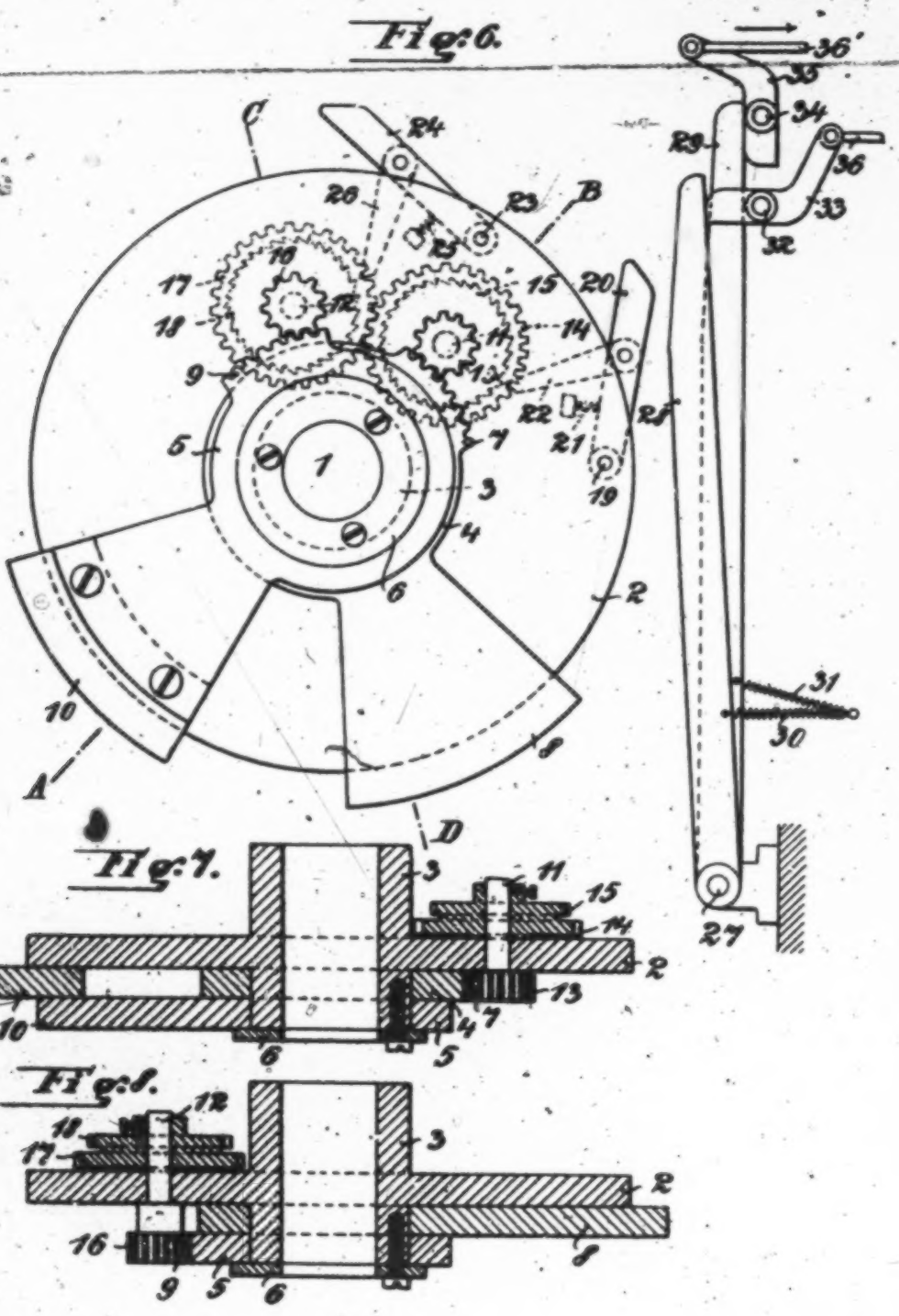


Fig: 7.

Fig: 8.

Witnesses:
B. Dommers
C. Lieber

Inventor
Franz Cecka
By Henry Orth & Co
Atty.

UNITED STATES PATENT OFFICE.

FRANZ CYCHA, OF CHEMNITZ, GERMANY, ASSIGNOR TO THE FIRM OF SCHUBERT & SALZER MASCHINENFABRIK AKTIENGESELLSCHAFT, OF CHEMNITZ, GERMANY.

APPARATUS FOR MAKING REINFORCED KNITTED GOODS.

1,213,333. Specification of Letters Patent. Patented Jan. 23, 1917.

Application filed July 22, 1914. Serial No. 852,416.

To all whom it may concern:

Be it known that I, FRANZ CYCHA, a citizen of the German Empire, residing at Chemnitz, in the Kingdom of Saxony, Germany, have invented certain new and useful Improvements in Apparatus for Making Reinforced Knitted Goods; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in a method of and apparatus for making reinforced knitted goods.

In the manufacture of knitted goods it is usual to loosen the loops when making reinforced parts, in order to impart sufficient elasticity to the reinforced parts. If the reinforced parts were made with the same close loops as the parts which are not reinforced, the goods would be close and unelastic in the reinforced parts.

In order to loosen the loops the knitting depth of the frame is increased by rocking the needle bar so as to produce loops of increased length, for which purpose the known loosening and closing cam is set at the beginning of the operation so as to produce for a definite part of the aggregate stroke of the thread guide a different knitting depth.

The object of the improvements is to provide a method of and an apparatus for knitting reinforced goods by means of which fashioned reinforced parts can be produced, *i. e.* reinforced parts which are of varying breadth.

With this object in view my invention consists in the matters to be described hereinafter and particularly pointed out in the appended claims, reference being had to the accompanying drawings and to the letters of reference marked thereon.

In said drawings Figure 1 is a diagrammatical view showing a knitting apparatus of known construction, Fig. 1ª, is a perspective view of the mechanism for actuating the needle bar. Figs. 2 and 3 are diagrammatical views showing respectively reinforced heel and toe portions of a knitted stocking prior to uniting the sides of the same, the reinforced portions having the forms now in use, Figs. 4 and 5, are similar views showing goods in which the reinforced portions are made according to my improved method, Fig. 6, is a view of a mechanism suitable for making reinforced goods according to my improved method, and Figs. 7 and 8, are cross-sections taken respectively on the lines A—B and C—D of Fig. 6.

The same letters of reference have been used in all the views to indicate corresponding parts.

Referring to Figs. 2 and 3, in the manufacture of the cross-hatched parts F of the heel and S of the toe the length of the loops is increased over the whole breadth of the head of the frame. However, if it is desired to make a reinforced ankle H, as is shown in Fig. 2, or a double sole D, as is shown in Fig. 3, a part only of the breadth a—b and a'—b' of the blank is reinforced, *i. e.* the portions a—c and d—b and a'—c' and d'—b', while the portions c—d and c'—d' are not reinforced. In such cases the knitting depth is temporarily varied by pressing the needle bar N from the position I into the position II, so as to increase the length of the loops. This is done by means of cams 8 and 10, mounted on a shaft 1. As the distance s of the said cams 8—10 is constant, the border lines 1—2 and 1′—2′ of such reinforced portions are straight, as is shown in Figs. 2 and 3. The breadth c—d and c'—d' between the reinforced portions can be set before the operation, but it can not be changed in the course of the manufacture of the goods. The border lines of the reinforced parts are always made by the same needles of the head of the frame

While for the proper comprehension of the object of the present invention the diagrammatical showing of the operating connection of the needle bar N, as given in Fig. 1, is obviously sufficient, the real relation of the parts and their proper coöperation may be ascertained by reference to Fig. 1ª, in which 41 designates the ordinary actuating cam for the needle bar N. The cam 41 is secured upon the shaft 1 and controls a bowl 42 carried by an arm 52 which with its shaft 47, is mounted to be able to oscillate. The needle bar N is adapted to swing on the pivots 45 and about the shaft 46, and is operatively connected to the said rocking arm 52 by means of links 43 and 44. If the actuating

cam 41 moves the bowl 42 radially outward, the rocking arm 32 will thereupon cause the needle bar N to swing toward the presser bar P as indicated by the arrow II. Upon the said shaft 1 there are mounted the cams 8 and 10 above described as producing the required additional movements of the needle bar for temporarily increasing the length of the loops to be formed. For this purpose the cams 8 and 10 are adapted to cooperate with a bowl 49' carried at the end of an arm 49, which is secured upon a rocking shaft 50. The latter shaft 50 is provided with a second arm 51 adapted to engage an extension 32' of the arm 32 controlling the operation of the needle bar N.

When by any suitable means the bowl 49' is shifted into the path of action of the loop loosening cams 8 and 10, the needle bar N will then be controlled by the said loop loosening cams 8 and 10 and moved according to the extent of the strokes of the latter.

By means of apparatus of this class such reinforced goods can not be made which are provided with fashioned reinforced portions, such as are shown for example in Figs. 4 and 5, where not only the breadth, but also the inner border lines of the reinforced portions are changed and made by different needles. Therefore the apparatus can be used only in such cases in which a reinforced portion is to be produced which begins in definite rows of loops and which is not changed in the course of the operation. But where fashioned reinforced portions are to be made in which the breadth is increased or reduced in the course of the manufacture the apparatus can not be used.

In order to obtain a variation of the knitting depth which corresponds to the desired form of the reinforced portions, the cams of the loosening and straightening cam are so mounted relatively to each other that their relative position can automatically be changed while the machine is in operation, so that the effect of the cams and the setting of the needle bar caused thereby and the variation of the knitting depth can be performed in the successive rows of loops at different points. Thereby I am enabled to produce reinforced portions which are gradually increased or reduced, such as is shown by way of example in Figs. 4 and 5. The cams are set in a suitable way by means of a jacquard card or a counting mechanism according to the desired form of the reinforced parts. Thereby I am also enabled to produce reinforced portions of uniform breadth in narrowed or widened goods.

In order that my invention be more clearly understood mechanism for putting the same into effect has been shown by way of example in Figs. 6 to 8. As shown in the said figures, a shaft 1 carries a disk 2 the hub 3 of which provides a loose support for disks 4 and 5 which are held in position by means of a washer 6. The disk 4 is provided with rack teeth 7 and it is made integral with a cam 8, and the disk 5 is formed with rack teeth 9 and is provided with a cam 10. In bores made in the disk 2 two shafts 11 and 12 are mounted. On the shaft 11 and at one side of the disk 2 a gear wheel 13 is mounted which is in mesh with the rack teeth 7, and at the opposite side of the disk 2 a gear wheel 14 and a ratchet wheel 15 are secured to the shaft 11.

To the shaft 12 a gear wheel 16 and at the opposite side of the disk 2 a gear wheel 17 and a ratchet wheel 18 are secured. The gear wheels 14 and 17 are in mesh with each other.

On a pivot bolt 19 of the disk 2 an arm 20 has a rocking support which projects beyond the disk 2 and is acted upon by a spring 21, and to the said arm a pawl 22 is jointed which is in engagement with the ratchet wheel 15. On a second pivot bolt 23 a similar arm 24 has a rocking support which is acted upon by a spring 25, and which carries a pawl 26 engaging in the teeth of the ratchet wheel 18. On a pivot bolt 27 secured to a fixed part of the framework two shift levers 28 and 29 are mounted which are normally held away from the disk 2 by springs 30 and 31 respectively. The lever 28 is in the path of the arm 20 and the lever 29 in the path of the arm 24.

On a pivot bolt 32 a bell crank lever 33 is mounted which acts on the lever 28, and on a pivot bolt 34 a bell crank lever 35 is mounted which acts on the lever 29. To the free ends of the said levers links 36 and 36' are jointed.

The operation of the mechanism is as follows: The links 36 and 36' are controlled by suitable means such for example as a jacquard card or another counting mechanism. For example, if the link 36 has been drawn to the right as is shown in Fig. 6 the bell crank lever 33 connected therewith forces the shift lever 28 forward and into opposition to the spring 30 and into position for engagement with the arm 20. If now the shaft 1 and the disk 2 are rotated the arm 20 gets in engagement with the shift lever 28 and it is pushed downward thereby, so that the pawl 22 mounted thereon operates the ratchet wheel 15. Thereby the gear wheel 13 as well as the gear wheel 14 are rotated, and the gear wheel 13 which is in mesh with the rack teeth 7 of the disk 4 moves the cam 8 away from the cam 10. As the gear wheel 14 is in mesh with the gear wheel 17 also the gear wheel 16 is rotated which is in mesh with the teeth 9 of the disk 5 carrying the cam 10, so that the said cam is moved in a direction opposite to that of the cam 8. Therefore the increase of the distance of the cams 8 and

10 corresponds to the double shifting movement imparted by the pawl 22 to the ratchet wheel.

Whenever the bell crank lever 33 forces the shift lever 28 forward upon each rotation of the shaft 1 the distance of the cams 8 and 10 is increased, so that in the blank being knitted the breadth of the portion which is not being reinforced is enlarged; because the movement of the needle bar causing the increase in the knitting depth ceases at an earlier moment and begins later. If on the other hand it is desired to reduce the portion which is not to be reinforced, the bell crank lever 35 must be moved by the counting mechanism. Thereby the shift lever 29 located in the path of the arm 24 is rocked forward, so that upon rotation of the shaft 1 and the disk 2 the arm 24 is rocked and the pawl 26 mounted thereon acts on the ratchet wheel 18, which carries along the gear wheels 16 and 17. The gear wheel 16 engages in the teeth of the rack teeth 9 of the disk 5 and shifts the cam 10 mounted on said disk toward the cam 8. Simultaneously the gear wheel 17 rotates the gear wheels 14 and 13 and through the latter the disk 4 and the cam 8 mounted thereon, so that now both cams are shifted relatively to each other a distance corresponding to the double path of the ratchet wheel 18.

By providing a jacquard pattern or selector or controlling mechanism of the proper form the beginning and the end of the change of the knitting depth can be varied as is necessary for obtaining the desired form of the reinforced part.

While in describing the invention reference has been made to a particular example embodying the same, I wish it to be understood, that my invention is not limited to the general arrangement and construction of the parts shown in the figures. For example, the mechanism for setting the cams 8 and 10 can be constructed in a different way, and the change of the knitting depth can be performed by other means.

I claim herein as my invention:

1. In an apparatus for making reinforced knitted goods, the combination with the needles, and their operating mechanism, of means comprising coöperating cams mounted on the same shaft for setting the needles according to the desired knitting depth, gear wheels operatively connecting the cams for movement in opposite directions, and automatic means to set said cams in different positions.

2. In an apparatus for making reinforced knitted goods, the combination with the needles, and their operating mechanism, of means for setting the needles according to the desired knitting depth, said means comprising a rotary disk, a pair of cam disks mounted on said disk coaxially thereof, and gear wheels mounted on the disk and connecting the cams for operation in opposite directions, and automatic means to set said cams in different positions.

3. In an apparatus for making reinforced knitted goods, the combination with the needles, and their operating mechanism, of means for setting the needles according to the desired knitting depth, and means comprising a rotary disk, a pair of cam disks mounted on said disk coaxially thereof, gear wheels mounted on the disk and connecting the cams for operation in opposite directions, and pawl and ratchet mechanism mounted on said disk and adapted to operate the gear wheels for setting the cams in different positions, and automatic operating means for the pawl and ratchet mechanism.

4. In an apparatus for making reinforced knitted goods, the combination with the needles, and their operating mechanism, of means for setting the needles according to the desired knitting depth, and means comprising a rotary disk, a pair of cam disks mounted on said disk coaxially thereof, gear wheels mounted on the disk and connecting the cams for operation in opposite directions, and duplicate pawl and ratchet mechanism mounted on said disk and adapted to operate the gear wheels for shifting the cams one away from and the other one toward each other, and automatic operating means for the pawls and ratchet mechanisms.

5. In an apparatus for making reinforced knitted goods, the combination with the needles, and their operating mechanism, of means for setting the needles according to the desired knitting depth, said means comprising a rotary disk, a pair of cam disks mounted on said disk coaxially thereof, gear wheels mounted on the disk and connecting the cams for operation in opposite directions, and duplicate pawl and ratchet mechanism mounted on said disk and adapted to operate the gear wheels for shifting the cams one away from and the other one toward each other, and automatic, selector controlled operating means for operating the pawl and ratchet mechanisms.

6. In a knitting apparatus, the combination of knitting needles, operating mechanism therefor, means for controlling the knitting depth of said needles comprising a pair of revoluble controlling members adapted to assume variable positions relative to each other, and means for varying the controlling positions of said revoluble controlling members during the knitting operation, whereby the timing in the change of the knitting depth may be varied in accordance to the pattern to be worked.

7. In a knitting apparatus, the combination of knitting needles, operating mechanism therefor, means for controlling the

knitting depth of said needles comprising a pair of revoluble controlling members adapted to assume variable positions relatively to each other, a pair of operating members one for each of said revoluble controlling members, said pair of operating members being operatively interconnected to actuate said controlling members synchronously in opposite directions, and shiftable driving members for each of said operating members and adapted to be actuated independently of each other during the knitting operation, whereby the timing in the change of the knitting depth may be varied in accordance to the pattern to be worked.

8. In a knitting apparatus, the combination of knitting needles, operating mechanism therefor, means for controlling the knitting depth of said needles comprising a pair of revoluble controlling members adapted to assume variable positions relative to each other, a pair of operating members one for each of said revoluble controlling members, said pair of operating members being operatively interconnected to actuate said controlling members synchronously in opposite directions, shiftable driving members for each of said operating members and adapted to be actuated independently of each other during the knitting operation, and operative connections in conjunction with each of said shiftable driving members for having said shiftable driving members controlled by a selector, whereby the timing in the change of the knitting depth may be varied in accordance to the pattern to be worked.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

FRANZ CECKA.

Witnesses:
F. E. Stecker,
W. H. Mücke.

PLAINTIFF'S EXHIBIT No. 57 571

Fourthly: For dividing the points from the filling up box when the filling up box is required to work on the selvidge of the fabric.

Dated Fourteenth day of December 1888.

GEORGE SOWTER

COMPLETE SPECIFICATION.

Improvements in Machinery and Apparatus Employed in the Manufacture of Knitted Fabrics.

GEORGE SOWTER 88 Clarendon Villas Robinhood Chase Nottingham in the Town and County of Nottingham, Hosiery Manufacturer do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My improvement relates to Knitting Machines employed in producing articles known as Hose, Socks, Pants, Vests or any similar articles in which widening and narrowings are required at any distance from the Selvedge. The usual mode of working the widening and narrowing instruments which are carried by rods or bars is by attaching such rods or bars to the Screw box carrying the Selvedge Stops and moving them at the same time by this mode only one uniform set of widenings or narrowings can be made, that is if the Instruments are set to work on 4 leads or 8 needles from the Selvedge, they traverse with the Stops and remain at one uniform distance from the Selvedge of the Fabric.

I propose to lengthen the Brackets carrying the Screw upon which Stops for the thread layer are traversed to the right or left and carry with these Brackets a seperate Screw upon which a Screw box with arm is attached to traverse the points or Instruments to the right or left.

Independently of the Selvedge Stops by the following means the outer end of Axle of the top Screw is provided with two Ratchett Wheels and Clawkers, the Clawkers are fastened with bolts to the ordinary Clawkers which drives the Screw upon which Stops for thread layers are traversed thus giving a simultanious movement to widen or narrow from the Selvedge in the usual manner, a second pair of Ratchett Wheels are placed on the axle of the top Screw, inside the end Bracket driven by Clawkers hinged to a lever rocking on an axle carried by the Framing of the Machine the lever having a rising and falling movement given it by a cam, to traverse the Instruments to the right or left, before the Screw and Stops for thread layer are put in motion, the axle for the cam for narrowing and widening moved by hand between the outside Clawkers are made longer to carry a Pentagonal cam and Ratchett Wheel, inside, to throw the Clawkers in gear on one side and out of gear on the other, alternately, by a small Ratchett hinged to the outside lever which has a rising and falling movement and is automatic in its action.

I also propose to use a wide set of points or Instruments for transfering the loops to the right or left as required, these leads and Instruments are carried on a rod attached to the narrowing machine and fitted up to the ordinary Instrument or coverer used on the Selvedge when in action, by this arrangement the ordinary instrument used on the Selvedge can be traversed by the top Screw, to the required distance, inside the Fabric from the Selvedge, and the wide set of Instruments brought down to the Instruments used on the Selvedge to transfer the loops when widening or narrowing is required any distance from the Selvedge of the Fabric so as to form pockets or gores without seams being required in Ladies Vests or forming the Heel of Stockings without seams and such like articles.

DESCRIPTION OF DRAWINGS.

Fig. 1. is a front view with cam shaft removed.
Fig. 2. a sectional end elevation.
Fig. 3. an end elevation.

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Fig. 4. a front elevation of one set of needles, showing one set of points or instruments attached to the Selvedge points or instruments and one set separated from the Selvedge points or instruments.

A. Fig. 1. is the screw for working the Selvedge points as in the ordinary machine with its box B ratchett wheels C and D, clawkers E and F, while I is part of machine standard. For working my improvements I lengthen the brackets H. H. carrying the screws A and L with its nut or box M. On the end of this screw are two pairs of ratchett wheels N and O, and P and Q the latter being worked from the clawkers E and F by attaching to them additional clawkers R and S, the other pair of ratchett wheels I work from the clawkers T and U by means of a cam and lever Y similar to those used for clawkers E and F.

I also lengthen the axle of the cam G. Fig. 3. and secure to it a cam V. Fig. 2. with an odd number of faces and a ratchett wheel W having twice as many teeth as the cam has faces. in the drawings they are shown as having 10 and 5 respectively.

On the lever K. Fig. 3. which operates the front clawkers E and F. I attach another clawker X. Fig. 2. which works the ratchett wheel W thus ensuring the automatic revolution of the cam V which throws the clawkers T and U in and out of gear alternately and causes the screw box M to traverse inwards or outwards as required.

In Fig. 4. *a. a.* are the needles on which the Fabric is made, *b. b.* the points or instruments for narrowing or widening in the usual manner. in addition to these I use a wider set of points or instruments *c. c.* at each end, which can be secured to *b. b.* by screws *d.* so that they can both be moved as one piece from the top screw. The points or instruments *c.* on the right hand side of Fig. 4. are shown separated from the Selvedge points or instruments, being partially revolved about the shaft *e.* but I do not confine myself to any particular method of separating the points or instruments.

Fig. 5. is a diagram of a pant, showing the two sets of widenings. 1. forming the split Hips. 2. are the sets of narrowings forming the twisted Ankles. 3. are needle narrowings which can be dispensed with if not required.

Having described the drawings of my apparatus which is applied to each end of the Knitting machine I will proceed to explain the working of the same so that it may be fully understood :—In making a Ladies Vest, fashioned gore or bosom, without a seam in the gore, I make the bottom portion of the body in the usual manner to the commencement, to widen and form the gore, the points or instruments *b* are traversed in 5 or 6 inches from the Selvedge as required, the wide points or instruments *c* are then secured by the screws *d* to the points *b. b.* Clawkers E and S. Fig. 1. acting on Ratchett wheels C and P attached to the screws A and L traverses the box B and M and points *c. b.* simultaneously extending the Selvedge and stops B one needle outwards, at the same time the clawker X is acting on Ratchett wheel W on cam V throws in gear clawker U and clawker T. out of gear, I then draw 2 or more courses clawker U acting on Ratchett wheel O traverses box M and points *c b* five needles inwards from the last widening, Clawkers E and S come into operation again extending the Selvedge and stops B one needle, at the same time clawker X acting on Ratchett wheel W on cam V throws in gear clawker T and clawker U out of gear, I then draw 2 or more courses clawker T coming into action on Ratchett wheel N traverses box M and points *c b* four needles outwards thus making two distinct rows of fashioning and leaving the points one needle inwards from the Selvedge when 18 or any other number of widenings required are made, I reverse the action of clawkers E and S and narrow in the same manner the number of courses required, forming the gore without a seam and leaving the Fabric the same width on the machine. I then disconnect the points or instruments *c* traverse the points *b* on to the Selvedge and proceed to make the remaining portion of the body in the usual manner.

To make a pant with what are known as Split Hips and Twisted Ankles without any seam in the Hips or Ankles, I traverse in the points 6 or 7 inches secure instruments *c* to points *b* by screws *d* and proceed to widen out the two Selvedges

5 1/2

same as in gore, six or seven leads as required, I then disconnect instruments traverse points *b* on to the Selvedge widen out the pants in the usual manner to gusit and narrow them down the thigh, make 5 or 6 inches plain, traverses in the points *b* on one side only 4 or more courses, secure instrument *c* to point *b* and proceed to narrow Ankle same as gore in Vest, for 10 or more leads as required.

Having now particularly described and ascertained the nature of my said Invention and in what manner the same is to be performed I declare that what I claim is

Firstly :—I claim for working the point or Instrument bars automatically, without being attached to Stops or Selvedge box.

Secondly :—To widen or narrow with the points or Instruments, without interfering with the Selvedge Stops at any distance required from the outside of the Fabric, also to widen or narrow on the one Needle at any distance the Instruments are set to.

Thirdly :—To form a set of Widenings or Narrowings extending or contracting the Fabric to the right and left of such widenings or narrowings.

Fourthly :—For dividing the points from the filling up box when the filling up box is required to work on the Selvedge of the Fabric.

Dated this 18th day of September 1889.

GEORGE SOWTER.

London : Printed for Her Majesty's Stationery Office, by Darling & Son, Ltd.—1890.

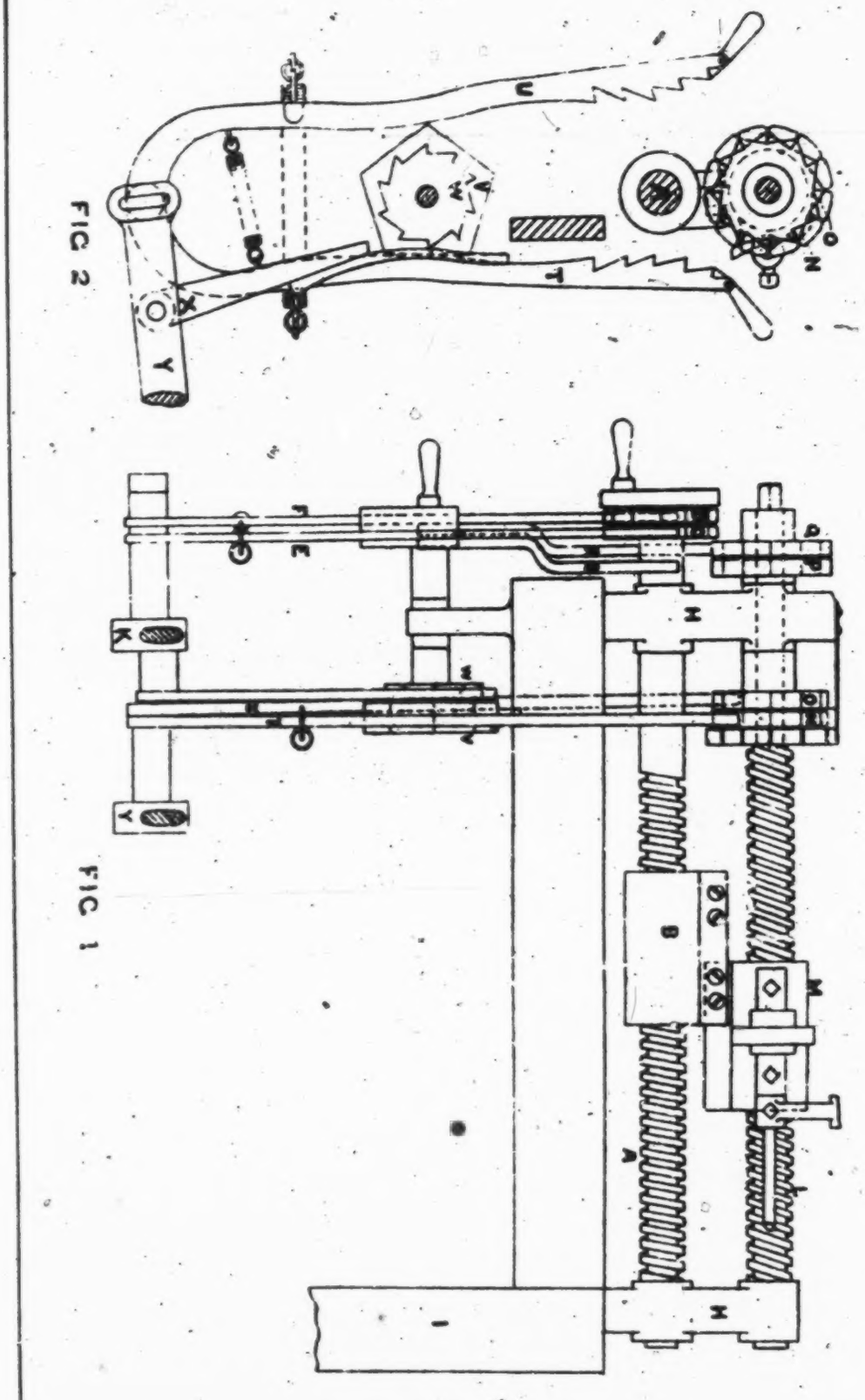


FIG 2

FIG 1

Printed by Harrison and Son Ltd
for the Majesty's Stationery Office 1950

This Drawing is a reproduction of the Original on a reduced scale.

A.D. 1888. Dec 18. N° 18,461.

SOWTER'S Complete Specification.

SHEET 2.

FIG 3.

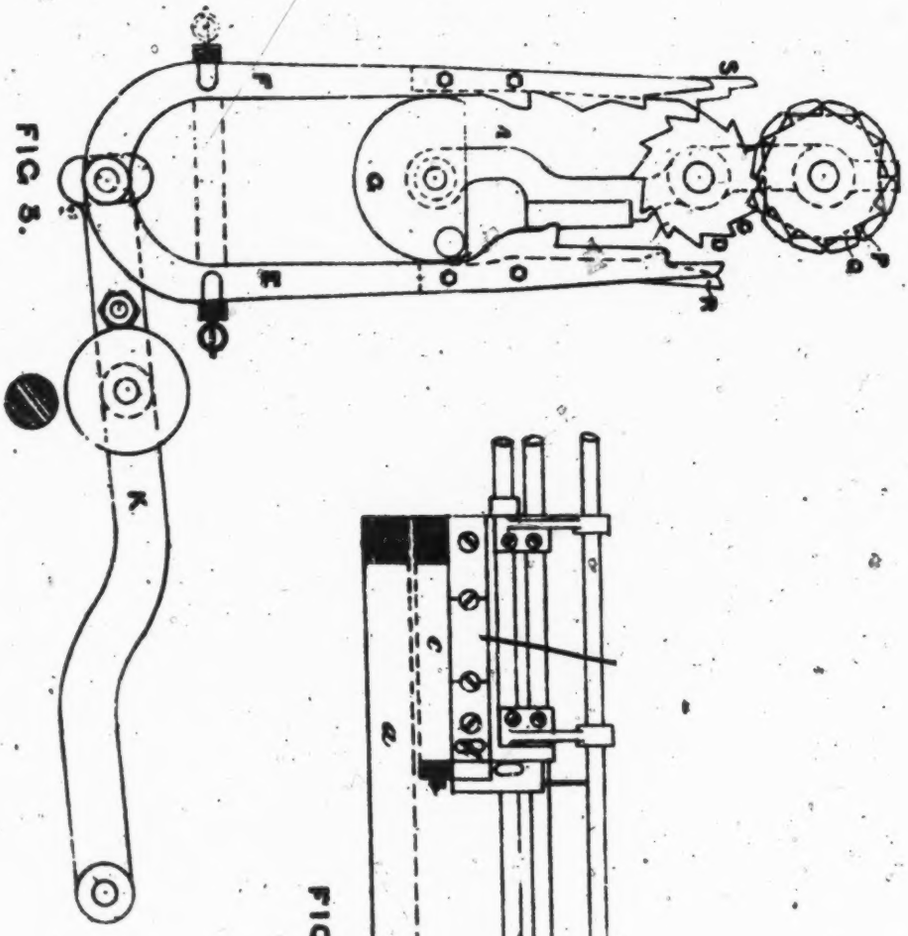
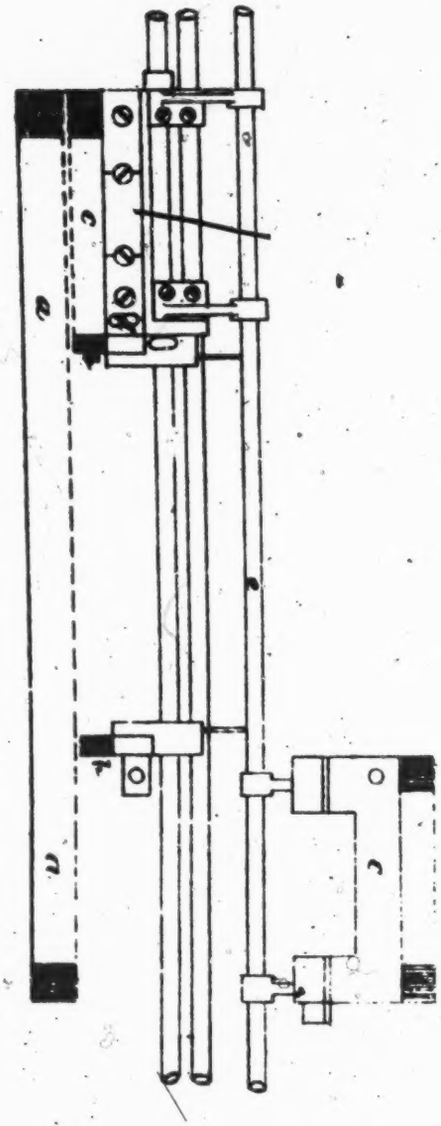


FIG 4



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576 1888, Dec 18. N° 18,461
SOWTER'S COMPLETE SPECIFICATION.

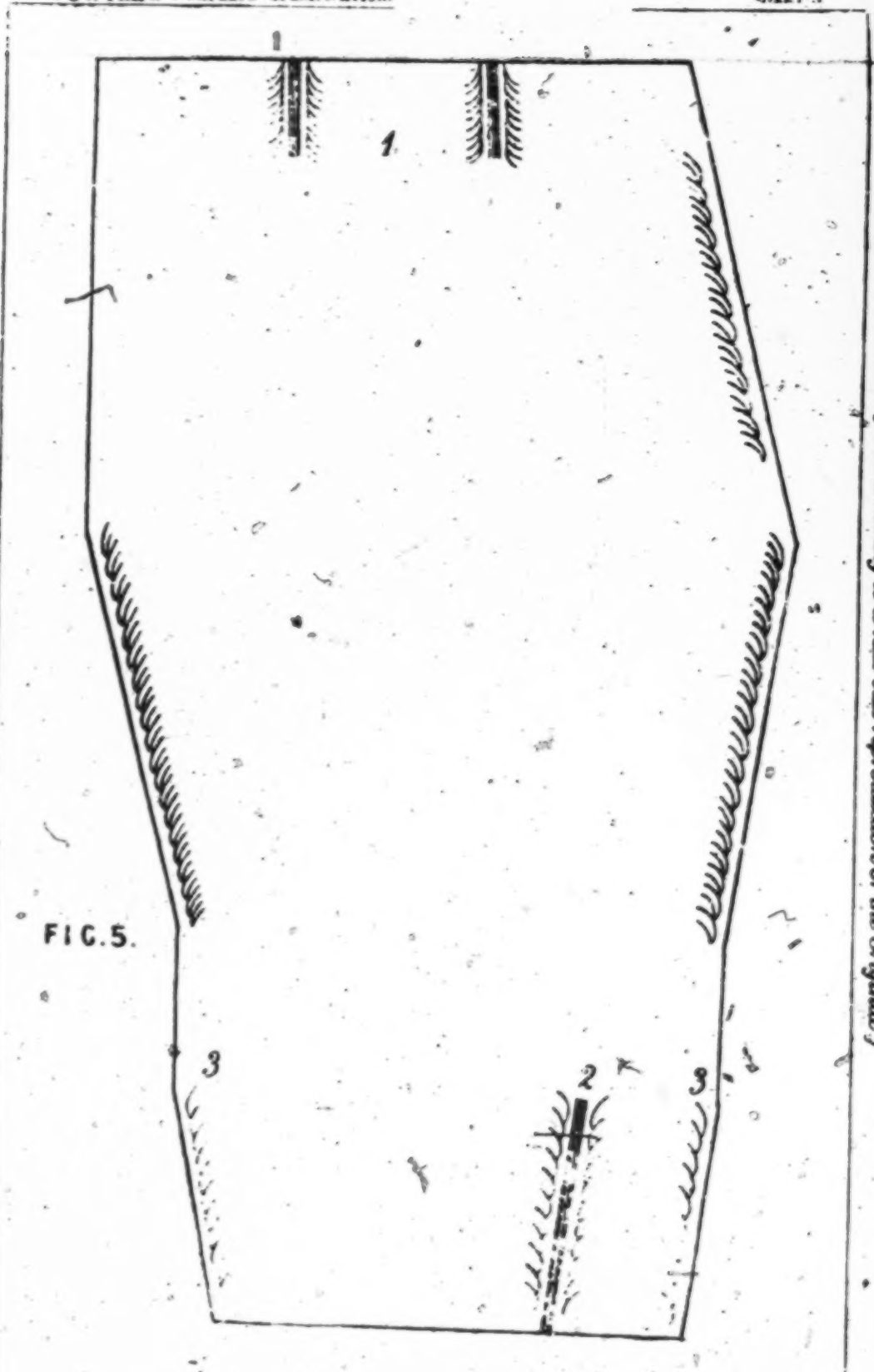

FIG. 5.

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Lessons Printed by Dawbarn and Son Ltd
for His Majesty's Stationery Office 1958

[This Drawing is a full-size reproduction of the Original.]

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DEFENDANT'S EXHIBIT B

THE MANUFACTURERS OF

THE

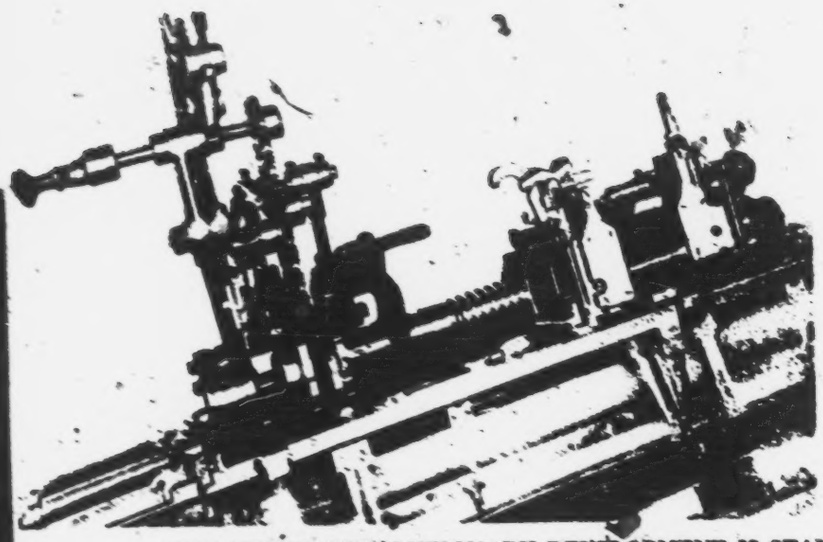
READING

FULL-FASHIONED
KNITTING MACHINE

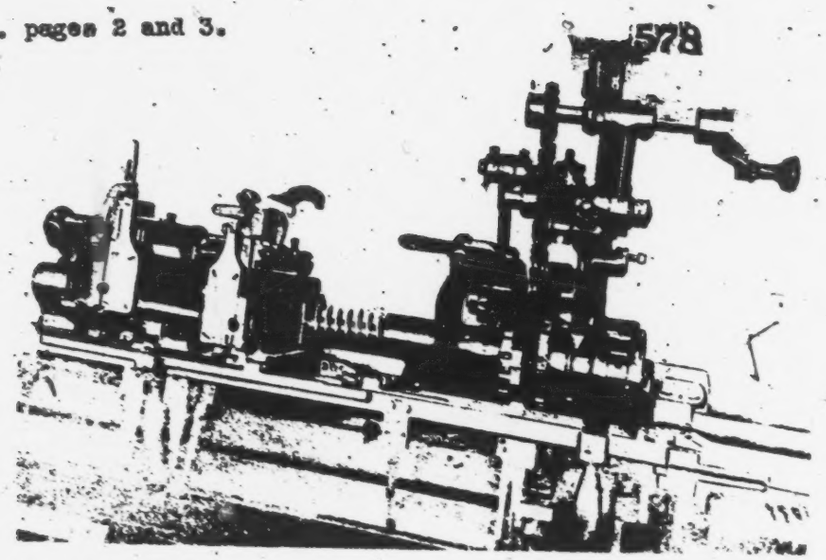
Announce

THE DOUBLE SPINDLE REINFORCED SELVEDGE ATTACHMENT

TEXTILE MACHINE WORKS



LEFT END SPINDLE



RIGHT END SPINDLE

THIS TRULY REVOLUTIONARY DEVELOPMENT IS STANDARD EQUIPMENT ON THE 1935 "READING" FULL-FASHIONED KNITTING MACHINE, AND OFFERS OUTSTANDING ADVANTAGES TO THE MANUFACTURER OF QUALITY FULL-FASHIONED HOSIERY:

Combines the following Attachments into a single compact unit:

Two Needle Closed Split Attachment for Leggers or Footers

Cotton Sole Attachment for Footers equipped with the Alternating Three Carrier Attachment

Alternating Slide Attachment on Leggers for making heel-in-heel in connection with the Alternating Three Carrier Attachment

Eliminates Plating Tackle from the Narrowing Head

Permits removal of the one-half inch rod formerly used to control the Plating Levers, thus providing easy removal and replacement of sinkers and dividers

Furnishes positive locking device for carrier rods when knitting Cradle Foot, Black Heel, or Plating

Includes Friction Box and Slide arrangement for making improved selvedge reinforcing in connection with the Alternating Three Carrier Attachment

Provides more rigid and flexible construction through the use of right and left end spindles

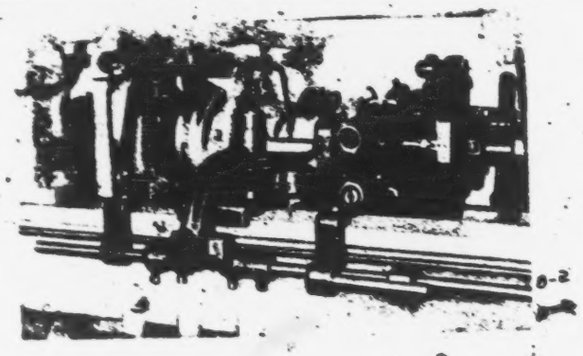
Makes uniform distribution of plating and reinforcing friction boxes possible

Includes means for producing a wide range of shadow clock designs, both symmetrical and non-symmetrical in shape

Main Chain Motion operation for both left and right spindles

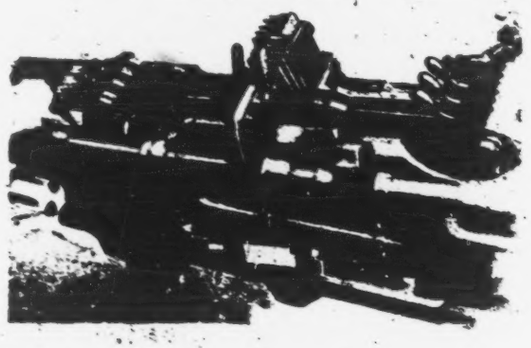
Improved Camshaft Rocker replaces the Cradle Type Rocker formerly used, producing more uniform and accurate rocking motion at high speed. Rocker action controlled directly from Reinforced Selvedge Spindles

Safety mechanism to prevent over-travel of spindle nuts



B-2

REAR VIEW OF IMPROVED CAMSHAFT ROCKER

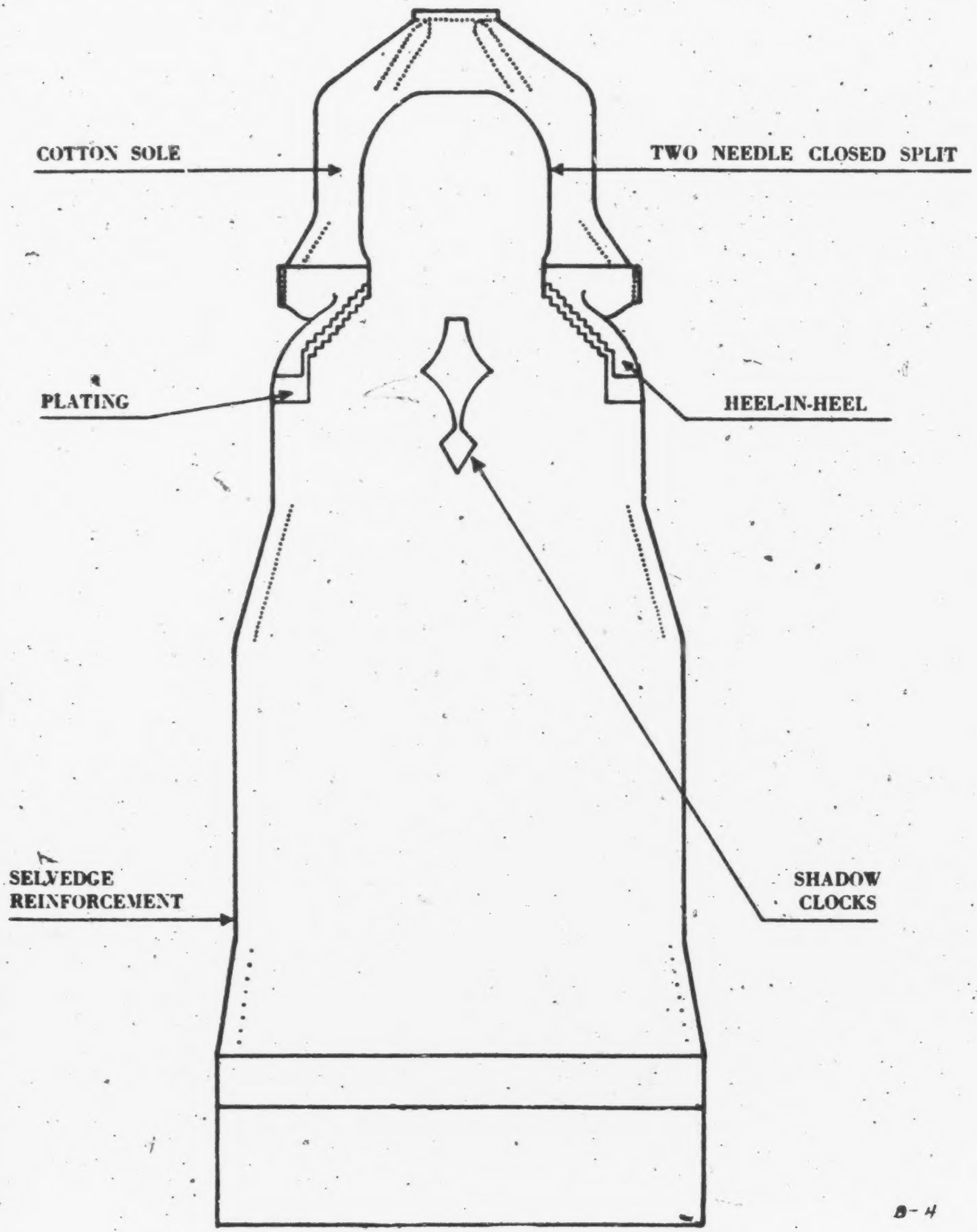


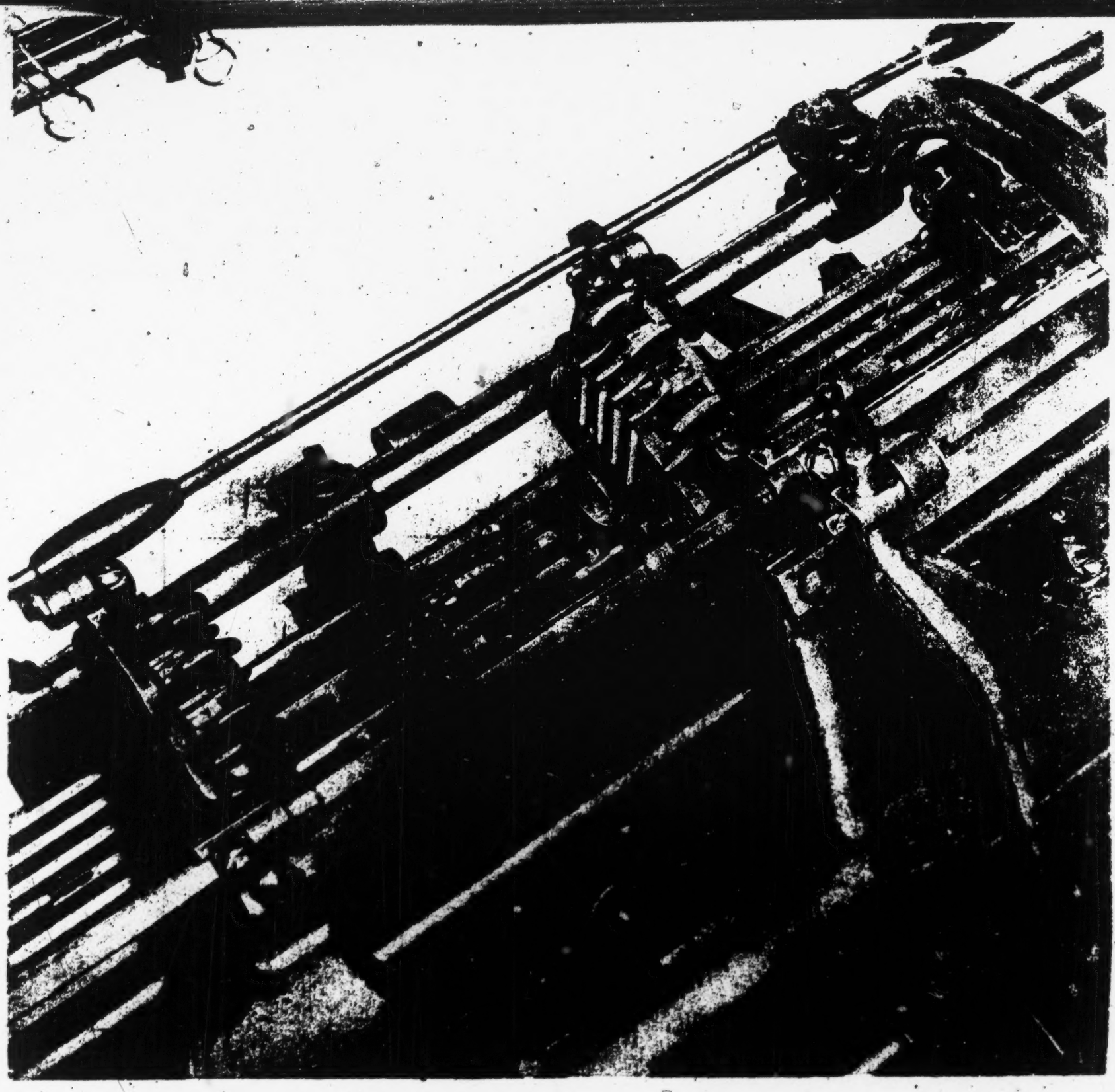
CARRIER ARRESTING AND PLATING UNIT ON NARROWING HEAD

B-3

THE READING

DOUBLE SPINDLE REINFORCED SELVEDGE ATTACHMENT





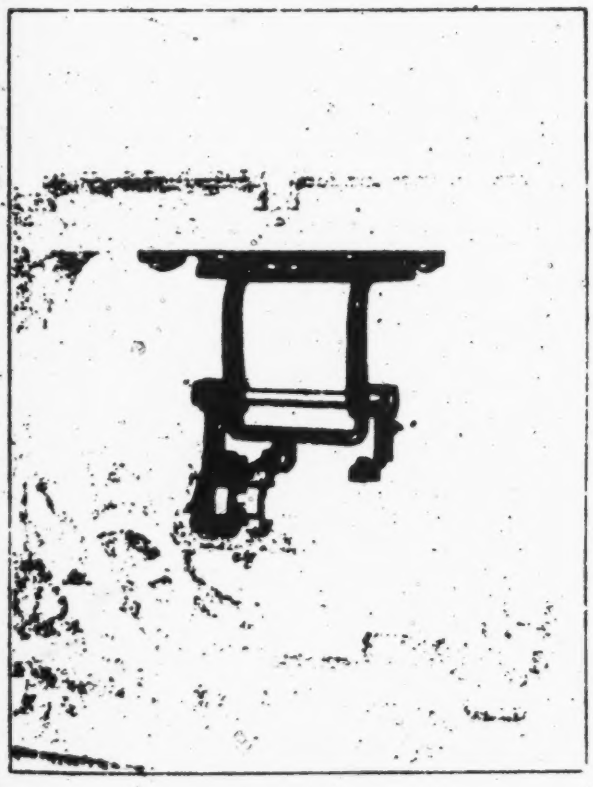
Full-Fashioned knitting machines equipped with the READING 3-Carrier Alternating Attachment and intended for making a cotton sole and cotton cradle foot can now be provided with the READING 2-Needle Closed Split Attachment. This device (patent applied for) eliminates the 4-needle overlap which causes a bulky line where sole and instep are joined. Write for particulars.

TEXTILE MACHINE WORKS • READING, PA.

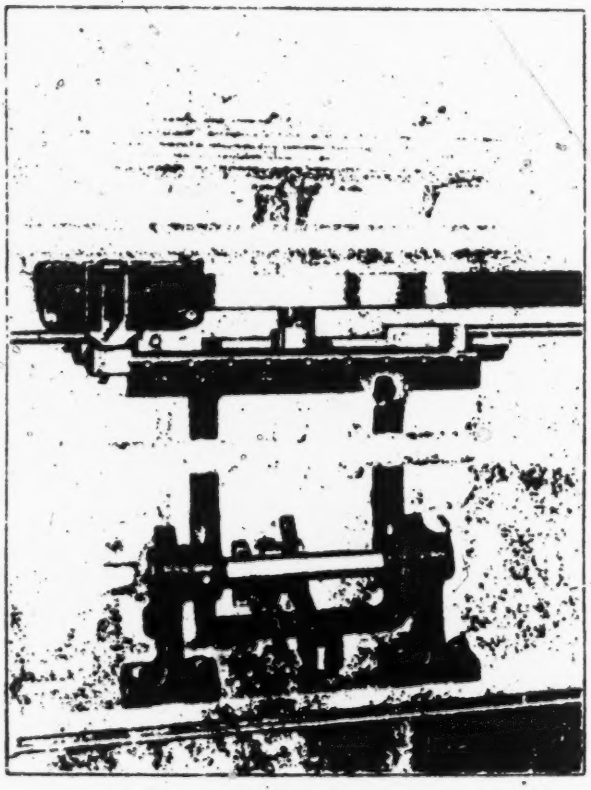
DEFENDANT'S EXHIBIT 580

DEFENDANT'S EXHIBIT D

M40. Reinforced Selvedge Attachment—Single Rocker



FRONT VIEW



REAR VIEW

In the manufacture of full-fashioned stockings having a pointed heel reinforcement or reinforcement in which the edges make an angle with the wales of the fabric it is absolutely essential that means be provided on the machine to furnish a variable rocking motion to the Regulating Shaft as the reinforcement is widened or narrowed. If this is not done the fabric will be drawn or puckered wherever a reinforcing thread is added. Where no rocking is done the loops are not large enough to accommodate an extra thread, thus resulting in an unsatisfactory fabric.

The Rocking Motion for the "Reading" Reinforced Selvedge Attachment is furnished by a device that is operated directly from the Coulier Motion. This means that the Rocker Motion is always in synchronism with the Carrier travel and insures absolute accuracy as regards duration of rocking.

The necessary oscillating motion is given to the Regulating Shaft by the action of a cam-piece, which when coming between the Rocker Cradle and the movable rocker slides, produces the desired movement. Accuracy of rocker slide movement at all times is assured because they are connected to the Reinforced Selvedge Narrowing Nuts by means of steel rods, and are always moved in synchronism with the nuts. Thus it is seen that every time the nuts receive a movement to increase or decrease the reinforcing carrier travel the duration of the rocking motion is increased or decreased the same amount and at the same time.

"Reading" Rocker Motions used in connection with the Reinforced Selvedge Attachment insure excellent and satisfactory fabric at all times and under all circumstances.

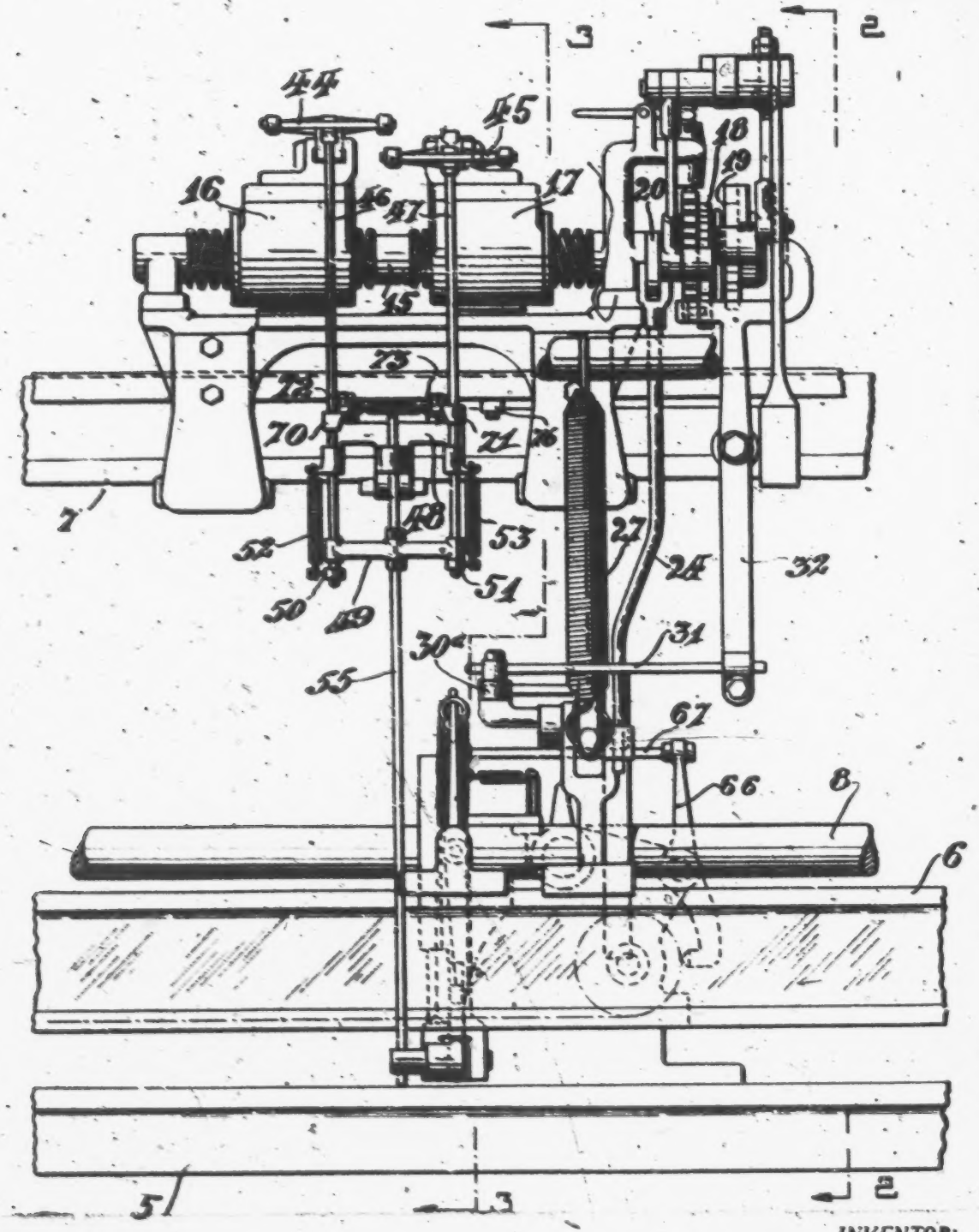
[fols. 582-591] DEFENDANT'S EXHIBIT E

Dec. 5, 1933. G. BITZER 1,938,207

CARRIER ROD CONTROL FOR SPLIT SEAM FABRIC

Filed May 28, 1931 5 Sheets-Sheet 1

Fig. 1.



INVENTOR:
Gottlob Bitzer.
BY
ATTORNEYS.

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Dec. 5, 1933. G. BITZER 1,938,207

CARRIER ROD CONTROL FOR SPLIT SEAM FABRIC

Filed May 28, 1931 5 Sheets-Sheet 2

FIG. 2.

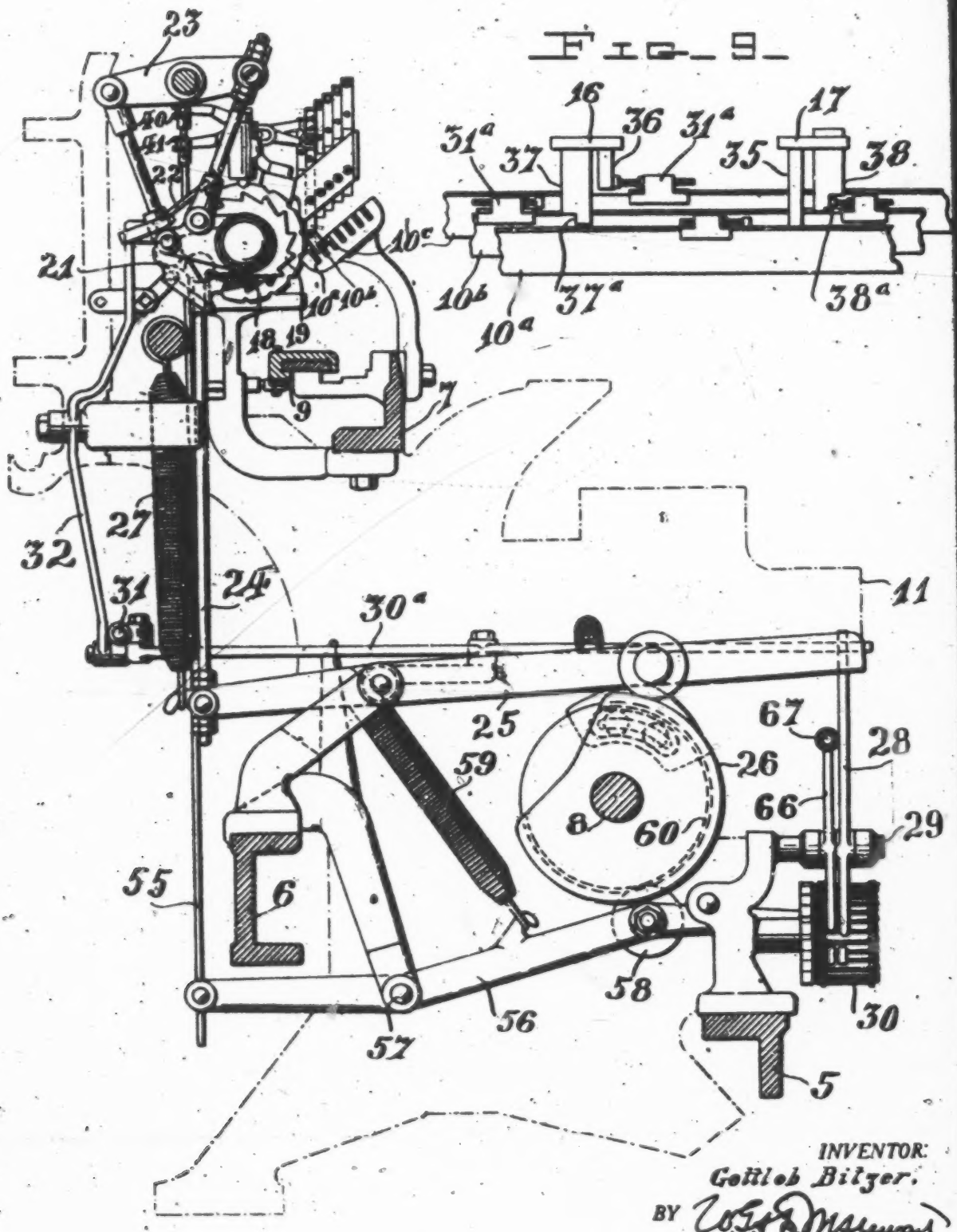

FIG. 9.

INVENTOR:
Gottlob Bitzer.
BY Cox & Moseley
ATTORNEYS.

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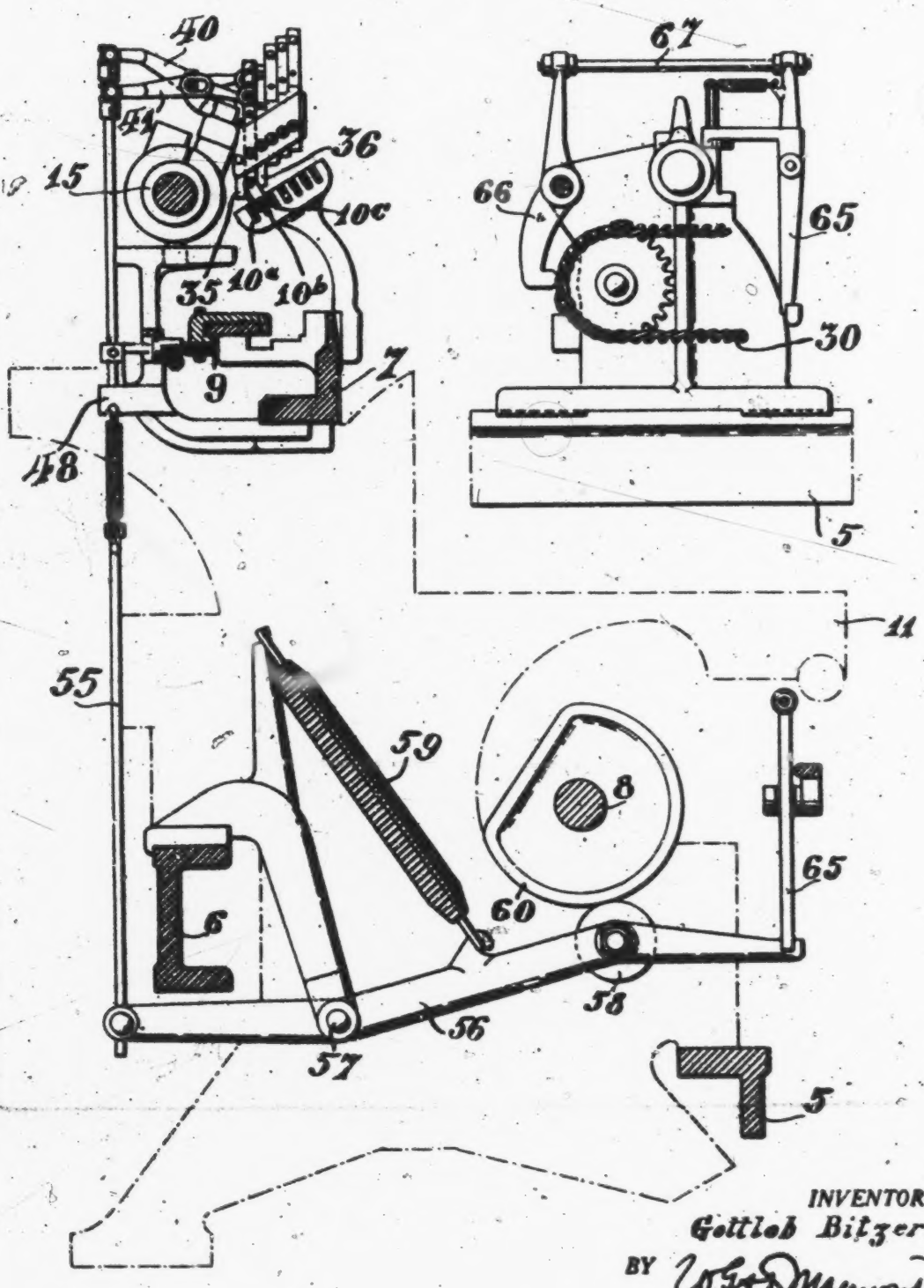
Dec. 5, 1933. G. BITZER 1,938,207

CARRIER ROD CONTROL FOR SPLIT SEAM FABRIC

Filed May 28, 1931 5 Sheets-Sheet 3

FIG. 3.

FIG. 4.



INVENTOR:
Gottlob Bitzer.
BY
ATTORNEYS.

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Dec. 5, 1933. G. BITZER 1,938,207

CARRIER ROD CONTROL FOR SPLIT SEAM FABRIC

Filed May 28, 1931 5 Sheets-Sheet 4

Fig. 5.

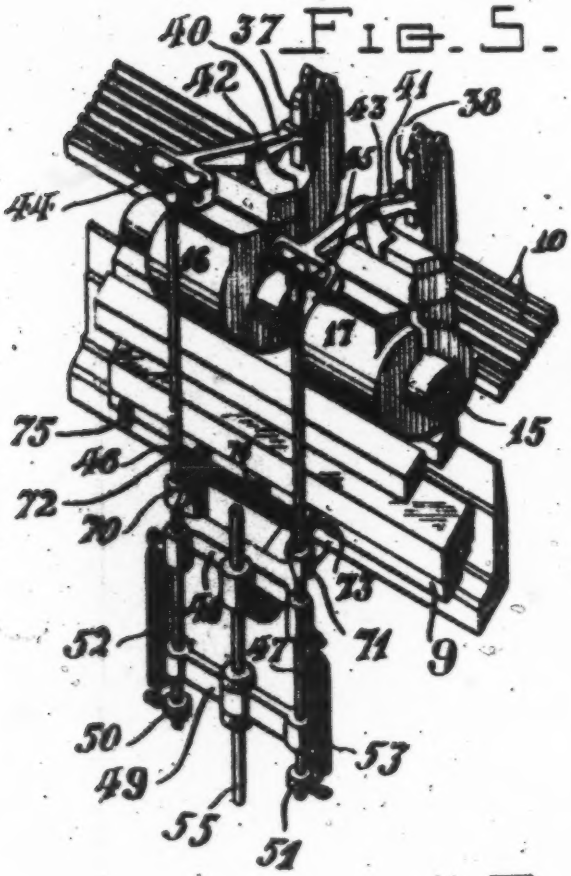

Fig. 6.

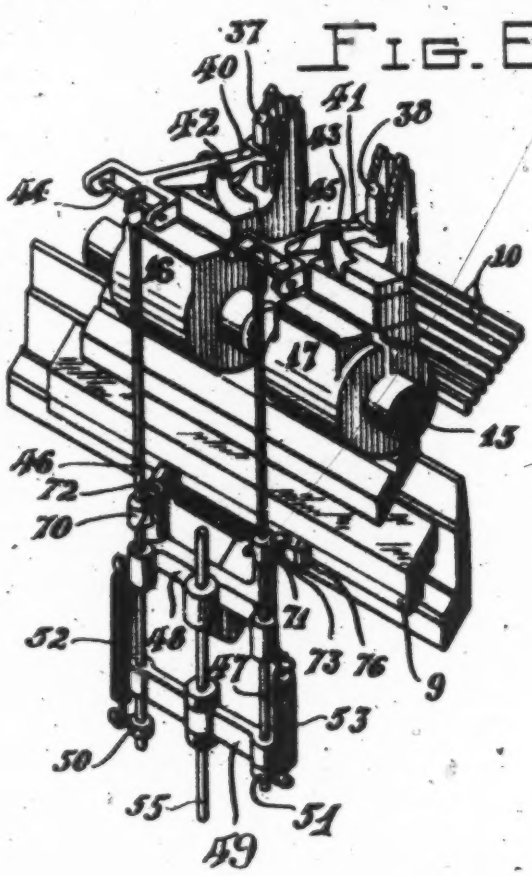

Fig. 7.

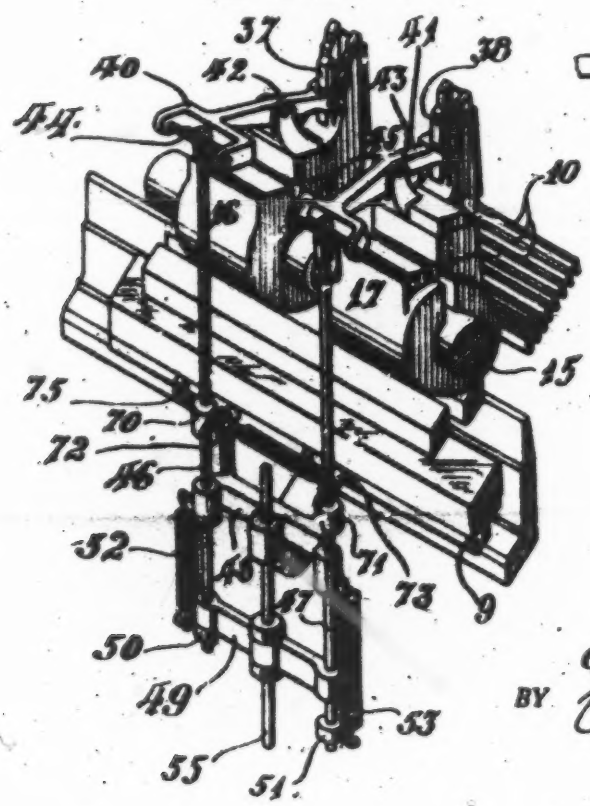

Fig. 8.

INVENTOR:
Gottlob Bitzer,
BY
ATTORNEYS.

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Dec. 5, 1933. G. BITZER 1,938,207

CARRIER ROD CONTROL FOR SPLIT SEAM FABRIC

Filed May 28, 1931 5 Sheets-Sheet 5

FIG. 11

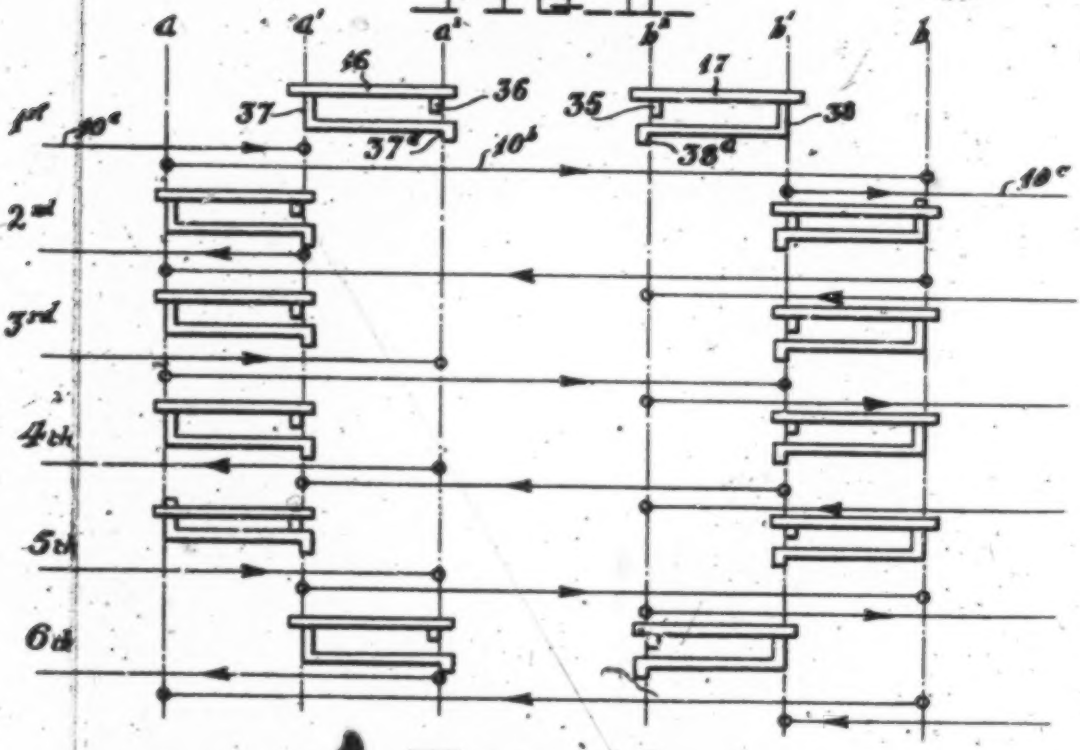
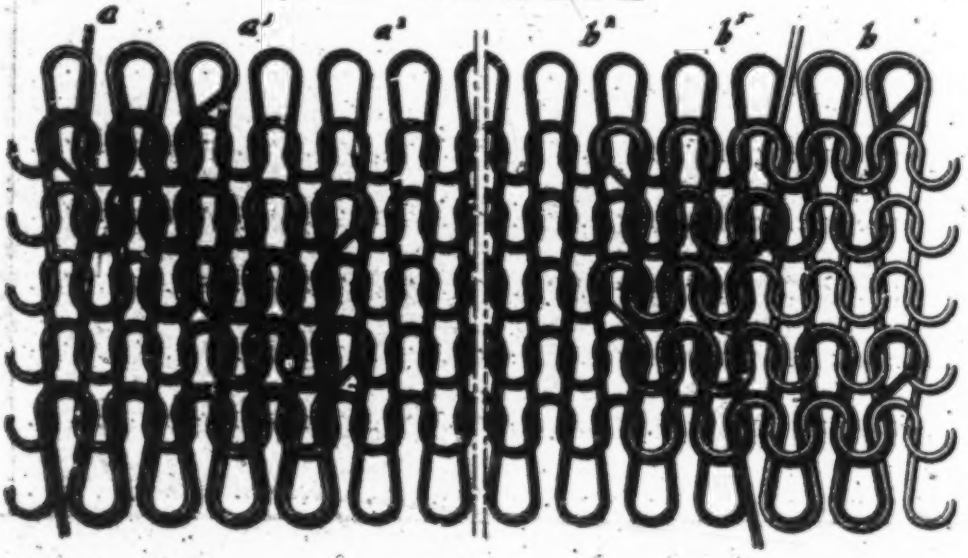


FIG. 10



INVENTOR:
Gottlob Bitzer.
BY
ATTORNEYS.

Patented Dec. 5, 1933 1,938,207

UNITED STATES PATENT OFFICE

1,938,207

CARRIER ROD CONTROL FOR SPLIT-SEAM FABRIC

Gottlieb Bitzer, Wyomissing, Pa., assignor to Textile Machine Works, Wyomissing, Pa., a corporation of Pennsylvania

Application May 23, 1931. Serial No. 540,524

11 Claims. (Cl. 66—123)

My invention relates to new and improved means for controlling the thread feeding traverse of the guide carriers of a full fashioned knitting machine having rod stop devices jointly shiftable from or toward one another for varying in successive courses the number of needles receiving such thread.

Such stop devices are old and well known and commonly employed for specific purposes as widening and narrowing travel of the rods controlled thereby, and the main objects of my present improvements are to adapt such stops for the production of well known sectional or split fabrics of varying section widths and to insure the formation of suture seams of determined loop construction uniting the irregular section edges.

With the above main objects in view my invention comprises the improved mechanism and its automatic operative control as fully described in connection with the accompanying drawings, the novel features thereof being specifically set forth in the appended claims.

Fig. 1 shows in rear elevation a preferred embodiment of my invention as applied to a usual full fashioned knitting machine, the latter being sufficiently illustrated by indication of certain of its well known parts.

Fig. 2 is a cross sectional view on the line 2—2 of Fig. 1, indicating additional parts of such known knitting machine.

Fig. 3 is a cross sectional view, similar to Fig. 2 but taken on the line 3—3 of Fig. 1.

Fig. 4 is a front elevation of the lower portion of the mechanism shown in Fig. 1.

Figs. 5, 6 and 7, are similar perspective detail views showing respectively three different positions of the nut-carried rod engaging slides determined by slur cock bar action on their control mechanism.

Fig. 8 is an enlarged showing of the latch mechanism actuated by the slur cock bar.

Fig. 9 is a fragmentary detail of the carrier rods and their engaging slides, indicating the off-set extensions of certain of the latter.

Fig. 10 is a fragmentary showing of a sectional fabric produced by my improvements, the loops being greatly enlarged to show their interengagement.

Fig. 11 is a diagrammatic showing of the carrier rod movements in successive courses corresponding with the several courses of the fabric shown in Fig. 10.

The drawings indicate a straight or full-fashioned knitting machine of usual construction and well known operation sufficiently disclosed for the purposes of the present improvements by showing its front beam 5, back beam 6, center bed 7, main cam shaft 8, slur-cock connecting bar 9 and carrier rods 10, all supported on or mounted in a series of frame members 11 (dotted outline). The operation of the machine is as heretofore, cam shaft 8 imparting determined movements, one of which is the reciprocative traversing of slur-cock connecting bar 9, and the latter through known friction box connecting means, not shown, coincidentally traverses determined carrier rods 10, except as said rods individually engage adjustably positioned movement-arresting stop nut slides to vary the number of needles to which their thread is fed, as usual and readily understood.

Sectional or split-seam fabrics are commonly produced on such known machine by employing several carrier rods with their resting stop slides so set that successive portions of each needle series receives a different thread, and the several sections thus formed are united by overlapping feed on adjacent section needles producing suture seams as heretofore, the nature of such seams depending as usual on the stop feed control of the several rods.

The sectional fabric shown in Fig. 10 is of the above general nature, the knitted loops being greatly enlarged to show their construction, and the three sectional areas having varying widths with two uniting sutures inclined across the wales and preferably of the known closed seam type formed by a normal overlapping on two needles.

My invention as above stated relates to improved automatic control of the several rods employed in making sectional fabrics, and the particular construction of the drawings is adapted to produce the specific fabric shown in Fig. 10, as will now be fully described.

As a convenient means suitable for my present improvements, I preferably employ, as shown, a reversely threaded spindle 15 mounting jointly but reversely movable stop nuts 16 and 17 carrying as shown provision for a number of movably positioned rod stop slides adapting it for a variety of purposes as commonly desirable. Such spindle and its selective intermittent reverse rotations are not in themselves new and may be readily understood by the following brief description. Spindle 15 carries a pair of reversely toothed gears 18 and 19 and a freely swinging arm 20 mounting a pair of pawls 21 and 22 so linked to a cross arm 23 that movement of one pawl into engagement with its respective gear disengages the other

pawl from its gear, providing for selected racking of spindle 15 by swinging of arm 20 as readily understood. Arm 20 is swung through a connecting link rod 24 by lever 25 acted on by a cam 26 on main cam shaft 8, except as said lever is held in raised position against its tensioning spring 27 by a catch lever 28 pivoted at 29 and freed by a suitable button on usual pattern chain 30 of the knitting machine. Extra high freeing buttons move catch lever 28 sufficiently to swing transversely a lever 30ª, pivotally carried on lever 25, with a link connection 31 to a lever 32 arranged to swing cross arm 23 in selectively positioning a pawl 21 or 22.

It will be readily seen that the above described known step mute in connection with usual end stops, not shown, may be readily employed to control the individual traverse of the three carrier rods required to feed the three separate threads of the fabric shown in Fig. 10, and to automatically vary the section widths thereof, as indicated, by proper position of suitable buttons on pattern chain 30. To form the closed seam sutures shown in the fabric of Fig. 10 however requires not only the normal setting of the slide stops to provide a two-needle overlap feed of the carrier rods, but in addition special construction and operative mechanism for the slide stops controlling the traverse movements of the carrier rod feeding the intermediate section of the fabric as will now be described.

In the drawings 16^a, 16^b and 16^c indicate the three guide rods employed, provided with suitably fixed dogs 21^a (Fig. 9) each adapted to engage its respective slide stop in rods 16 and 17, and the rods 16^a and 16^c engage, as usual, end stops, not shown, to limit their outward travel as heretofore. Rod 16^a travels between its usual end stop and engagement of its dog with the inner face of its slide stop 35 in rod 17; and in similar manner rod 16^c travels between its end stop and engagement of its dog with the inner face of its slide stop 36 in rod 16. Intermediate rod 16^b is provided with two dogs, as shown, which normally limit its travel by engaging the outer faces of special slide stops 37 and 38 carried in the respective rods 16 and 17, but, when the latter are raised as will be described later herein, engage instead the two-needle off-set extensions 37^a and 38^a of said stops. It will be understood that the respective end and slide stops will be so set that the normal rod travel above described will provide for a two needle overlap feed required for the closed seam suture shown, except as rods 16 and 17 are shifted, when the additional two needle travel, provided by slide stop extensions 37^a and 38^a, are employed for rod 16^b. And it will be readily understood that with the special dogs 21^a, 21^a, thereof engaging the outside faces of slides 37 and 38 in rods 16 and 17, a closing together of said rods will increase the respective traverse of said rod, thus increasing the number of needles fed thereby to widen the fabric, and a separation of said rods will reduce the number of needles supplied with thread to narrow the fabric. And the rods 16^a and 16^c engaging the inner faces of their respective stops 35 and 36 will correspondingly vary the number of needles fed thereby, with a normal overlap feed of two needles of those supplied with thread from rod 16^b.

Such normal over-lap feed of two needles is effective except as the rods 16 and 17 are shifted to vary the needle feed of the respective rods, when additional travel of two needles for the rod 16^b is required, as will be clearly set out later herein in connection with description of diagrammatic Fig. 11. And, as shown in the drawings, this extra feed is provided by vertical lift of the nut slides 37 and 38 to bring off-set faces 37^a and 38^a in position to engage dogs 21^a, 21^a. The controlled lift of said slides 37 and 38 is preferably effected as follows:

As clearly seen in the drawings, the special slide stops 37 and 38 have pins at their upper ends engaging the forked ends of their respective shifting levers 40 and 41, each pivotally mounted at 42 and 43 on its particular nut 16 and 17, and each lever preferably having, as shown, a slotted engagement with its pivot pin to permit disengagement with its stop slide when desired. The opposite ends of each lever 40 and 41 are widely forked as shown, with connecting rods 44 and 45 each forming a slide connection for the hooked end of its respective operating rod 46 and 47. The rods 46 and 47 are mounted to vertically slide in the special bearings of frame carried bracket 48 and end bearings of a yoke arm 49, and each rod carries a fixed collar 50, 51, tensioned by a spring 52, 53 to normally maintain it in vertically shifted position with said collar seated against its rod bearing in yoke 49. Yoke 49 is connected by a rod 55 to the end of a lever 56 pivoted at 57 and its opposite end carrying, as shown, an anti-friction roller 58 normally held by spring 59 in contact with a cam 60 on main cam shaft 8. A low portion of cam 60 permits spring 59 to swing lever 56 to lower rod 55 which it will be readily seen causes shifting levers 40 and 41 to raise slide stops 37 and 38. A latch lever 65 controlled, as shown by a button on pattern chain 30, through lever 66 and connecting rod 67, determines the times of the cam operation to raise slide stops 37 and 38.

As more clearly seen in Figs. 5 to 8, each rod 46 and 47 carries a fixed collar 70 and 71, engaged by spring joined latches 72 and 73 pivotally mounted on bracket 48. Said latches operate to hold their respective rods in lowered positions to which they are moved by lever 56, against the tension of rod springs 52 and 53 each adapted to reversely move its respective rod on release of its individual latch. Each latch, as shown, has an extension 72^a and 73^a fully movable in one direction, but when moved in the reverse direction swinging its latch 72 or 73 free of engagement with its rod collar 70 or 71. Slur cock connecting bar 9, or an integral extension thereof is shown as carrying fixed projections 75 and 76 which are adapted to contact with the respective latch extensions 72^a and 73^a to release their respective latches 72 and 73 during reverse movements of said bar 9.

The action of a properly set button on pattern chain 30, it will be seen, frees lever 56 for operation of cam 60, said lever moving downward and, through rods 55, 49, moves downward rods 46 and 47 to swing levers 40 and 41 causing them to raise their slide stops 37 and 38 to bring offsets 37^a and 38^a into the line of travel of dogs 21^a on carrier rod 16^b. When rods 46 and 47 are thus moved downward, latches 72 and 73 engage against collars 70 and 71 and prevent springs 52 and 53 from reversely moving said rods after lever 56 is again held in inoperative position by latch 65. Each latch 72 and 73 is disengaged by its slur cock projection 75 or 76 to free its rod, when said rod springs act to swing their respective levers 40 or 41 to relower the slide stop 37 or 38 for normal action of the latter. The necessity of the raising of slide stops 37 and

38 to effect an additional feed of its carrier rod 10^b, and the further requirement for separate lowering of said stops as above described, will be best understood in connection with the diagrammatic Fig. 11 and the following description of the same.

In Fig 11, the horizontal lines indicate the thread feed traverse of the several rods 10^a, 10^b and 10^c in successive courses corresponding with the successive courses of the fabric shown in Fig. 10; the arrow heads on said horizontal lines indicating their direction of travel in each course; and the vertical dotted lines the spacing of two needle shifts by which steps the nuts 16 and 17 are moved and the traverse of rod 10^b increased when its slide stops 37 and 38 are raised. Keeping in mind that the stop nuts 16 and 17 are moved apart to effect narrowing of the middle fabric section, and brought together to widen said fabric section; and that the stop slides for the rods 10^a and 10^c are set with relation to special stop slides 37 and 38 to cause a normal overlap feed of two needles, the traverse of the several courses is as follows:

In the first course rod 10^a travels from its end stop to the inner face of its stop 35 in nut 17 feeding its thread to the vertical line a', rod 10^b travels to the outside of its special stop 37 in nut 16 feeding its thread from line a to line b, and rod 10^c travels to its end stop, a normal two-needle overlap feed occurring between the lines a—a' and b'—b. In the second course the spindle 15 has been turned through a pattern chain button action to spread the stop nuts two needles, the rod 10^c will now travel two needles further to contact with its slide 36 in nut 16, feeding its thread to the vertical line b^2, rod 10^b would travel normally two needles less, due to outward movement of its slide 38 in nut 17, but a button on pattern chain 30 has acted to free lever 56 from its latch 65, and cam 60 has operated on said spring tensioned lever 56 to cause it to lift the slide stops 37 and 38 to bring their offset extensions 37^a and 38^a in action, thus rod 10^b will travel an extra two needles feeding its thread to the vertical line a instead of a', and rod 10^a will travel to its end stop, this feeding causing an overlap of four needles on the right due to the widening shift of the stop nuts, and a normal overlap of two needles at the left. The slur cock projection 75, which travels equally with the carrier rods 10, acts in this course to free latch 72 thus lowering slide 37, while slide 38 remains raised to be normally lowered on reverse movement of said slur cock connecting bar 9 by its projection 76 contacting to free latch 73. In the third course shown the spindle has remained at rest and slide 38 lowered to normal stopping position, rod 10^a will now travel two needles more due to shift outward of its slide 35, or to the line a^2; rod 10^b will travel from line a to line b'; two needles less than its previous travel, and rod 10^c will travel from line b^2 to its end stop; this travel causing a four needle overlap at the left and a normal two needle overlap at the right. In the fourth course shown the spindle has not been turned. In this course rod 10^c travels from its end stop to line b^2 as its stop has not been changed; rod 10^b travels from line b' to line a'; rod 10^a travels from line a^2 to its end stop; this feed causing a normal two needle overlap at the right and a normal two needle overlap at the left. In the fifth course the spindle has not been turned but both slides 37 and 38 have been raised to place the off-sets 37^a and 38^a in rod stopping position, slide 38 however being returned to normal during this course; rod 10^a travels from its end stop to line a^2 as in the third and fourth courses; rod 10^b travels from line a' to line b, which is two needles more than normal due to its offset stop 37^a acting; rod 10^c travels from line b^2 to its end stop; the feeding described causing a normal two needle overlap at the left and a four needle overlap at the right. In the sixth course shown, the spindle has been turned to move stops 16 and 17 inward two needles each, and slide 37 has been returned to normal. In this course rod 10^c will travel from its end stop to line b', two needles less; rod 10^b travels from line b to line a, two needles further than in the fourth and fifth courses because of inward movement of stop 38; rod 10^a travels from line a^2 to its end stop; in this course a normal overlap of two needles occurring at the right and a four needle overlap at the left due to the two needle additional feed of rod 10^b.

It is thought that this diagrammatic showing will make clearer the action of the mechanism previously set forth. In turning the spindle to move the stops 16 and 17 apart, the slides 37 and 38 may be raised at the same time to bring into action their off-set portions 37^a and 38^a, one being immediately returned to normal and the other returned to normal in the next course. In turning the spindle to move the stops toward each other, the slides 37 and 38 are first raised so that rod 10^b may move additionally two needles, the slides are then returned to normal and the spindle rotated to close the nuts 16 and 17.

The narrowing and widening changes are ordinarily effected in separated course with normal overlap courses with the previous setting of the stop; and it will be noted that in narrowing the intermediate fabric effected through stops 37^a, 38^a, the added overlap in the sutures occurs immediately in the narrowed course; but that in widening this added overlap by means of 37, 38 occurs in a course immediately before that in which the change in the rod feed is effected by shifting of the nuts 16, 17.

While the suture shown is of the construction commonly known in the art as a closed seam, it is readily conceivable that by delaying the raising of the slides 37 and 38 until the rod 10^b has come to a preliminary rest against them, a delayed two needle feed may be secured by additional movement of said rod to their off-sets 37^a and 38^a, which would produce a usual open seam suture.

From the foregoing description of one specific embodiment it is believed the nature and operation of my improvements will be readily understood, and it is obvious that changes and modifications may readily be devised within the spirit of my invention as defined in the following claims.

What I claim is:

1. In a full fashioned knitting machine having a plurality of reciprocatively traversed thread carrier rods each adapted to feed a separate thread to a different section of needles with overlap joint feeding on end needles of said sections, and stop devices for said rods simultaneously movable from and toward one another to vary in successive courses the number of sectional needles fed by the respective rods, of pattern-controlled means for temporarily varying the

stops for one of said rods, and means operated by said rod traverse mechanism for selectively returning said stops to normal position.

2. In a full fashioned knitting machine, a sectional fabric forming mechanism comprising, a plurality of reciprocative carrier rods adapted to feed their sectional threads to a series of needles, rod stop carrying devices simultaneously movable from and toward each other to vary the fabric section widths, rod-engaging stops in said carriers movable in one direction to vary the positions of their rod engagements, pattern controlled mechanism for moving said stops, and means actuated by the rod reciprocative mechanism for selectively moving said stops in the opposite direction.

3. In a full fashioned knitting machine, a sectional fabric forming mechanism comprising, a plurality of reciprocative carrier rods adapted to feed their sectional threads to a series of needles, rod stop carrying devices simultaneously movable from and toward each other to vary the fabric section widths, rod stops in said carriers having normal and variable rod-engagements selectively positionable, pattern controlled mechanism for cooperatively moving said carriers from and toward one another and for positioning said rod stop variable engagements, and means actuated by the rod-reciprocative mechanism for selectively restoring the normal rod stop engagements.

4. In a full fashioned knitting machine, a sectional fabric forming mechanism comprising, a plurality of reciprocative carrier rods adapted to feed their sectional threads to a series of needles, rod stop carrying devices simultaneously movable from and toward each other to vary the fabric section widths, stepped rod-engaging slides in said carriers, pattern controlled mechanism for selectively moving determined steps into rod-engaging position, and means actuated by the rod-reciprocative mechanism for changing the step engagements of said slides.

5. In a full fashioned knitting machine, a sectional fabric forming mechanism comprising, a plurality of reciprocative carrier rods adapted to feed their sectional threads to a series of needles, rod stop carrying devices simultaneously movable from and toward each other to vary the fabric section widths, stepped rod-engaging slides in said carriers, pattern-controlled mechanism for simultaneously moving said slides to position determined rod-engaging steps thereof, and means actuated by the rod reciprocative mechanism to selectively reposition said slides.

6. In a full fashioned knitting machine, a sectional fabric forming mechanism comprising, a plurality of carrier rods adapted to feed their sectional threads to a series of needles, rod stop nuts movable from and toward one another to vary the fabric section widths, rod-engaging stop slides in said nuts having off-set rod engaging extensions, pattern controlled mechanism for moving said off-set extensions into rod-engaging positions, and means actuated by the rod reciprocative mechanism for moving said slide extensions from rod engaging positions.

7. In a full fashioned knitting machine, a sectional fabric forming mechanism comprising, a plurality of carrier rods adapted to feed their sectional threads to a series of needles, rod stop nuts movable from and toward one another to vary the fabric sectional widths, rod-engaging stop slides in said nuts having off-set rod engaging extensions, pattern controlled mechanism for moving said off-set extensions into rod-engaging positions, latch means for retaining said slides in off-set position, and latch releasing means operated by the rod-reciprocative mechanisms.

8. In a full fashioned knitting machine, a sectional fabric forming mechanism comprising, a plurality of carrier rods adapted to fed their sectional threads to a series of needles, rod stop nuts movable from and toward one another to vary the fabric section widths, rod-engaging stop slides in said nuts having off-set rod engaging extensions, pattern controlled mechanism for moving said off-set extensions into rod-engaging positions, latch means for retaining said slides in off-set position, and means for releasing said latches separately in successive reciprocations of the carrier rods.

9. In a full fashioned knitting machine, a sectional fabric forming mechanism comprising, a plurality of carrier rods adapted to feed their sectional threads to a series of needles, a reversely threaded spindle, stop nuts reversely movable on said spindle, a rod-engaging stop slide in each nut having an off-set rod-engaging extension, mechanism to raise said slides to position said off-set extensions in rod engaging position, pattern controlled mechanism for raising said slides to position said off-set extensions, and means operated by the rod reciprocating mechanism for relowering said slides.

10. In a full fashioned knitting machine, a sectional fabric forming mechanism comprising, a plurality of carrier rods adapted to feed their sectional threads to a series of needles, a reversely threaded spindle, stop nuts reversely movable on said spindle, a rod-engaging stop slide in each nut having an off-set rod-engaging extension, mechanism to raise said slides to position said off-set extensions in rod engaging position, pattern controlled mechanism for raising said slides to position said off-set extensions, latches for holding said slides in raised positions, and latch releasing means selectively operated in successive carrier rod reciprocations.

11. In a full fashioned knitting machine, a sectional fabric forming mechanism comprising, a plurality of carrier rods adapted to feed their sectional threads to a series of needles, a reversely threaded spindle, stop nuts reversely movable on said spindle, a rod-engaging stop slide in each nut having an off-set rod-engaging extension, mechanism to raise said slides to position said off-set extensions in rod engaging position, pattern controlled mechanism for turning said spindle and raising said slides jointly to position their off-set extensions, latches for holding said slides in raised positions, and carrier rod actuated mean for relowering said slides separately in successive courses.

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March 25, 1930. R. E. SCHLETTER 1,752,206

ATTACHMENT FOR FLAT KNITTING MACHINES

Filed July 25, 1928 4 Sheets-Sheet 1

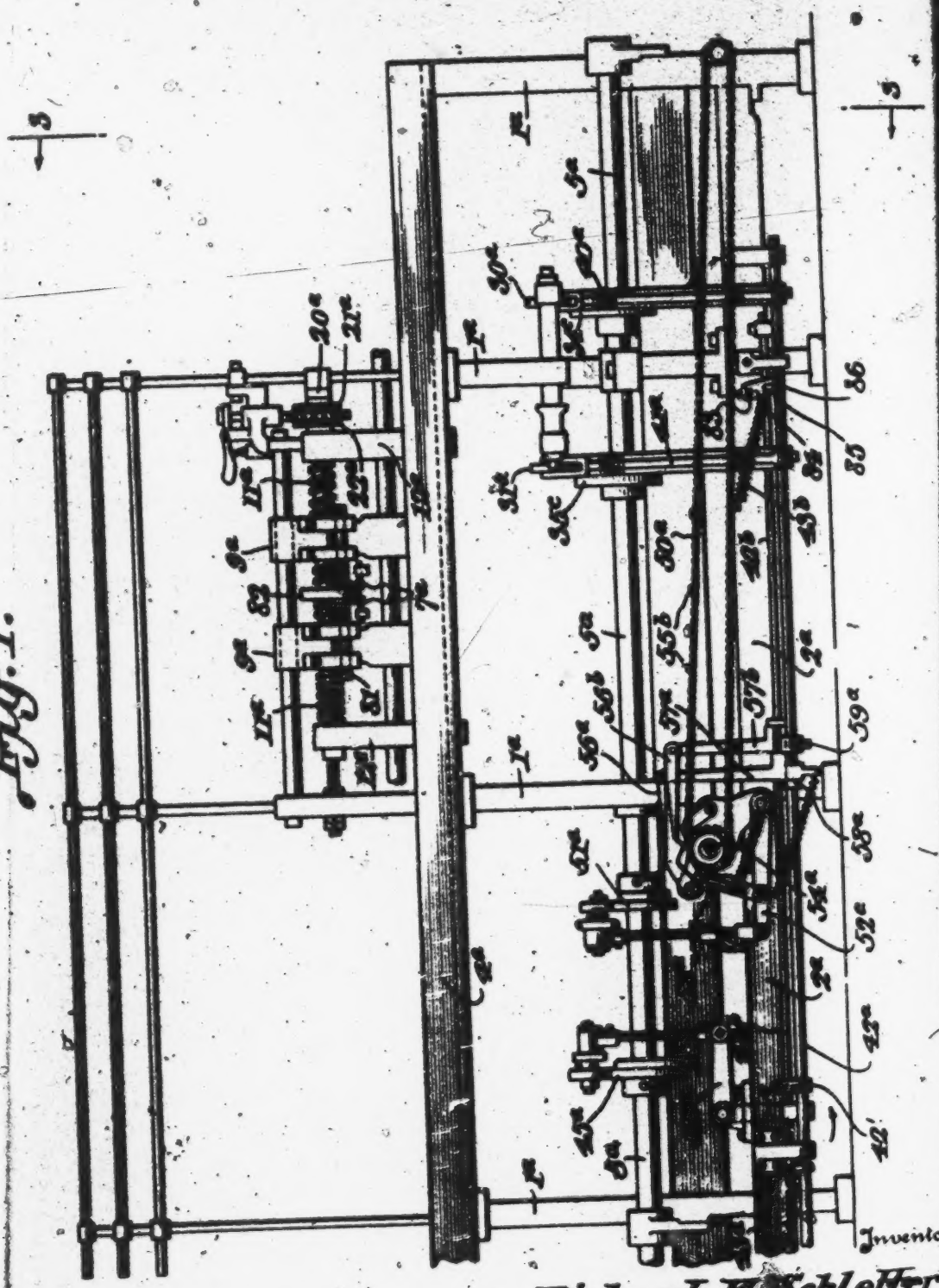

Fig. 1.

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ATTACHMENT FOR FLAT KNITTING MACHINES

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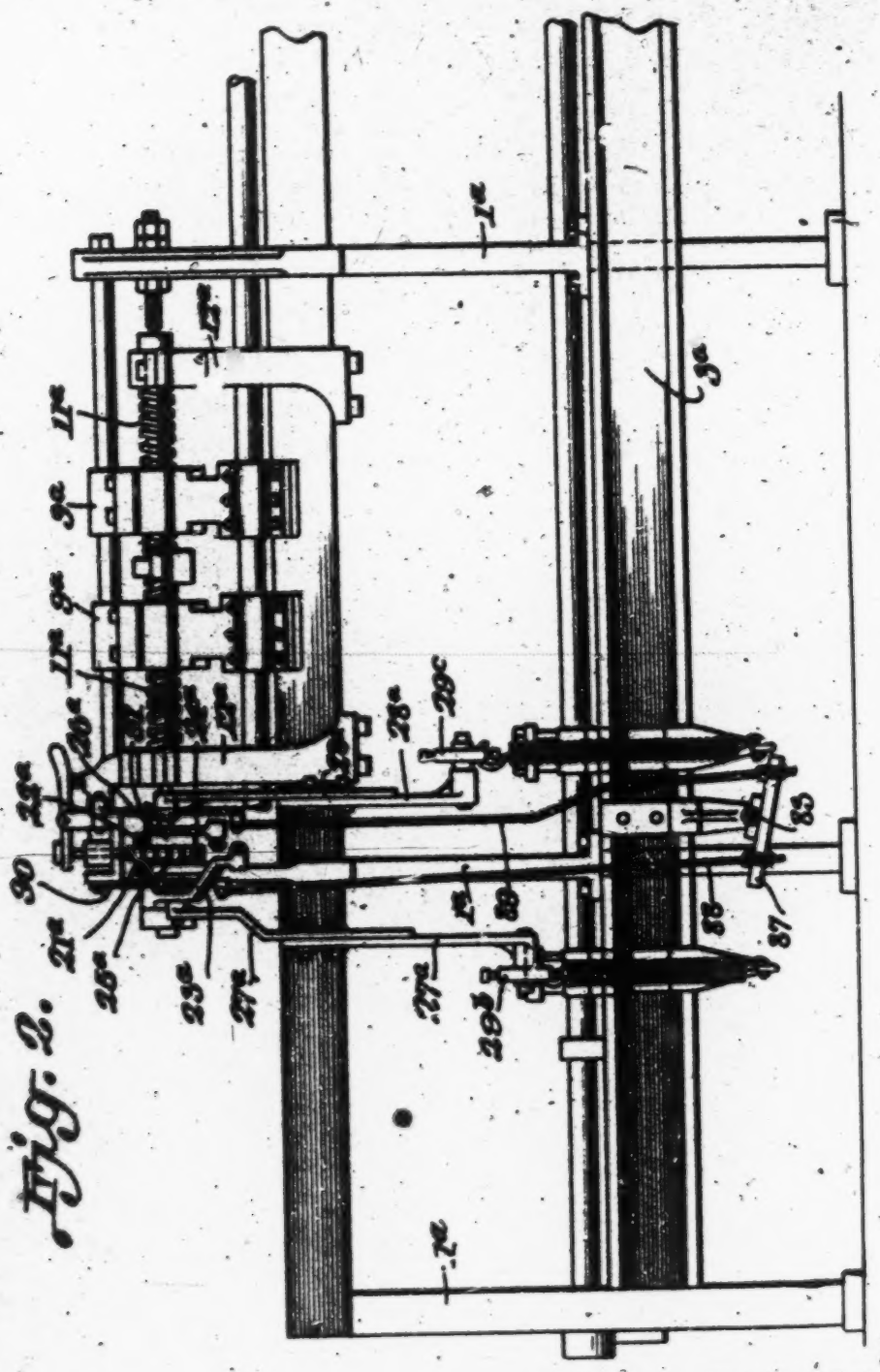

Fig. 2.

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ATTACHMENT FOR FLAT KNITTING MACHINES

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Fig. 4.

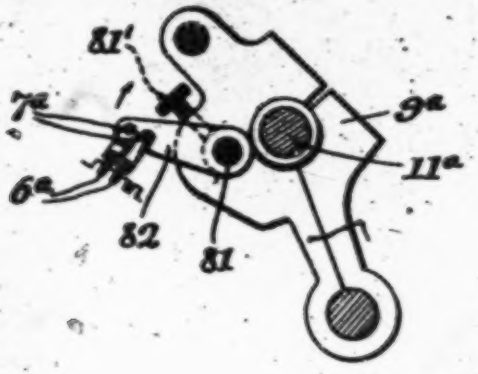
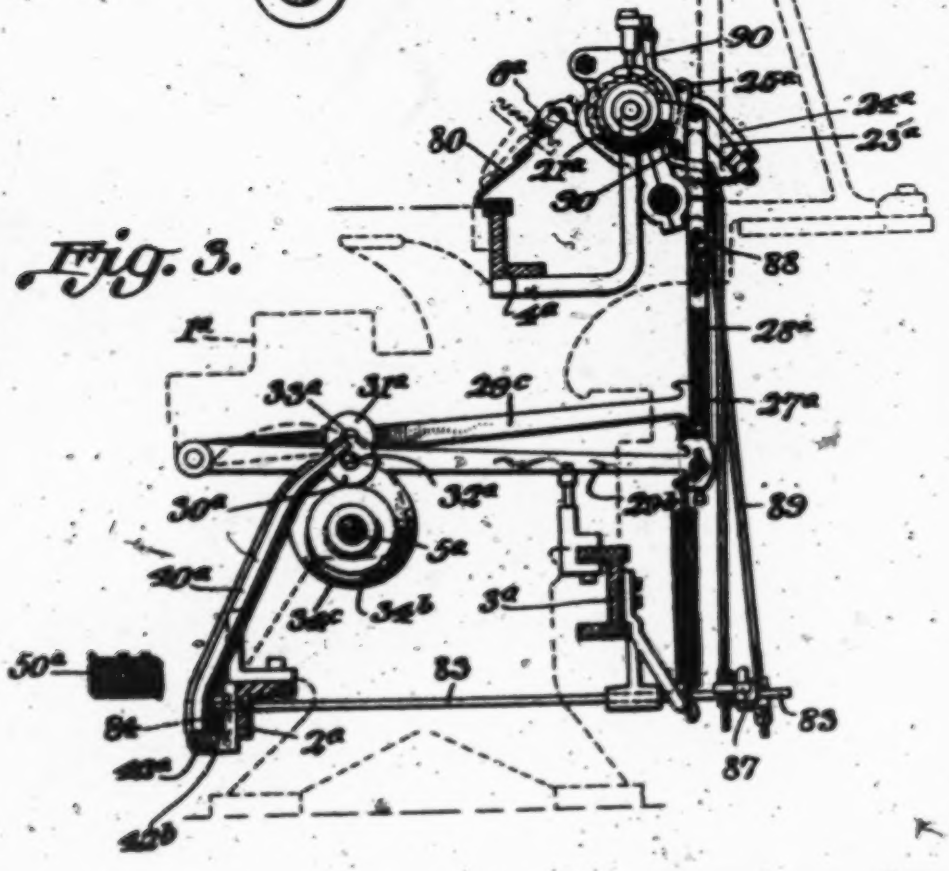


Fig. 3.



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ATTACHMENT FOR FLAT KNITTING MACHINES

Filed July 25, 1928 4 Sheets-Sheet 4

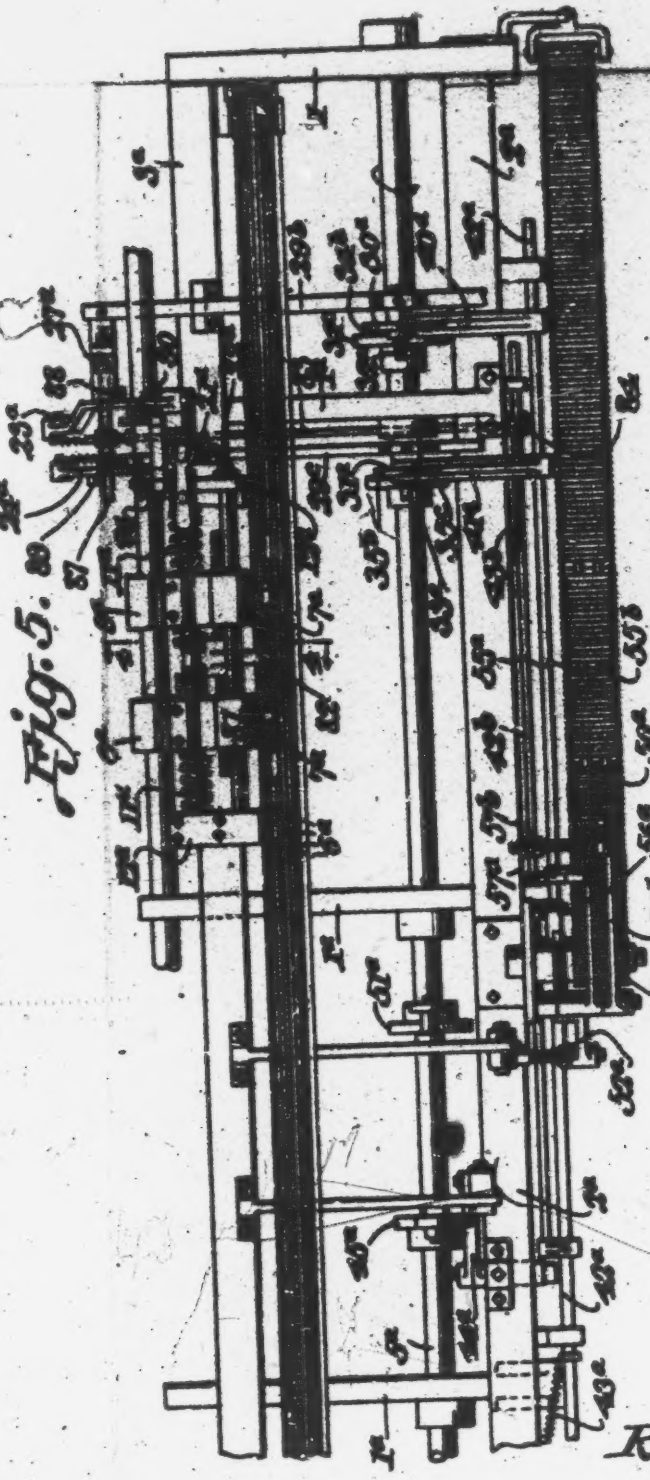

Fig. 5.

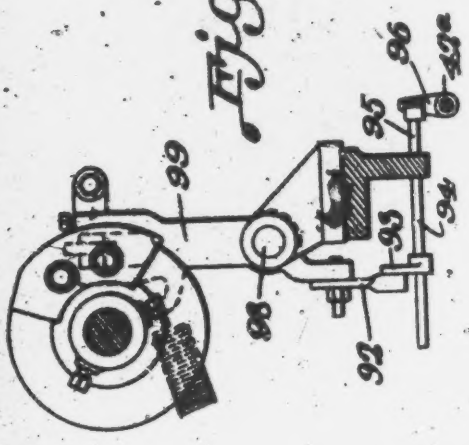

Fig. 7.

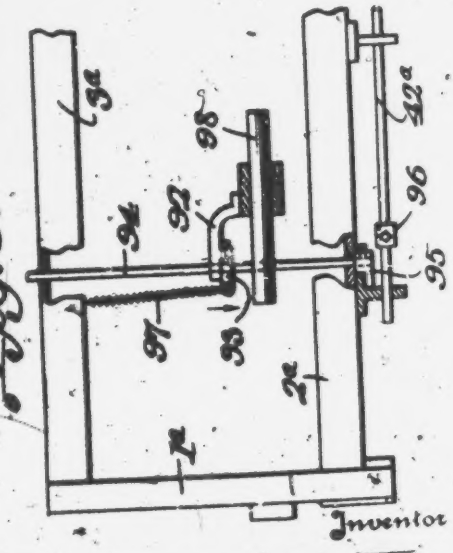

Fig. 6.

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1,752,206

UNITED STATES PATENT OFFICE

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ATTACHMENT FOR FLAT-KNITTING MACHINES

Application filed July 25, 1928. Serial No. 295,285.

My said invention relates to an attachment for flat knitting machines, the present application being in part a continuation of my application Serial No. 66,916, filed November 5, 1925, now Patent 1,713,628, May 21, 1929. It is an object of the invention to provide special stops for yarn-guide carrier rods that have a variable traverse, such as are used for making clocks, for split-seam work, etc. The structure herein shown has several advantages over that described in said patent the first of which is that in the present instance I require but one chain to operate both the ratchet mechanism and the reversing means therefor. Second, but one friction box is required in the present instance regardless of the number of auxiliary yarn carrier rods employed, while in the disclosure of the patent a separate friction box was required for each yarn carrier rod. These friction boxes utilize considerable power when in operation and the elimination of several of them aids materially in speeding up production, produces better work, necessitates less repairs to the machine, and the machine is easier to operate. Third, the parts are more positive in their action by means of the attachment about to be described.

Referring to the drawings, which are made a part of this application and in which similar reference characters indicate similar parts:

Fig. 1 is a front elevation of so much of the machine as is necessary to a showing of the invention,

Fig. 2, a rear elevation of the same,

Fig. 3, a vertical section on line 3—3 of Fig. 1,

Fig. 4 a detail of parts shown in Fig. 3, on an enlarged scale,

Fig. 5, a plan showing my attachment,

Fig. 6, a plan partly in section, of means to prevent a certain operation when the narrowing means is in operation, and

Fig. 7 is a fragmentary elevation, partly in section, showing parts seen in Fig. 6.

In the drawings the reference numeral 1^a indicates the main frame of a flat knitting machine, 2^a, the front beam; 3^a, the back beam; 4^a, the center bed; and 5^a, the main cam shaft. The numeral 80 designates the yarn carriers, mounted upon the usual longitudinally movable carrier rods 6^a, which latter are moved by the usual mechanism well known in this art. In Fig. 3 I have shown the second and third carrier rods, counting from the right, as operating splicing yarn guides with a variable stroke. Any one of the other rods may operate the guide for the body yarn with which the reinforcing yarns are interknitted, the travel of said rod being limited in any conventional or preferred manner, as by stops at the ends of the machine. In this disclosure of my invention, as in the foregoing showing, the novelty lies in the control of special stops for the several rods 6^a, limiting their path of travel, and thereby controlling the design. The nuts 9^a, 9^a in this case are the true rod-stops, and have the same function in this disclosure as in the showing in the application above referred to; i. e., determining the length of stroke of rods 6^a, and therewith the yarn carriers.

A right and left hand screw threaded spindle 11^a is journaled in bearings 12^a and carries thereon the nuts 9^a which in turn carry a supporting shaft 81 for the finger 82. Conventional abutment screws 7^a, 7^a are so located on the carrier rods that they can be made to engage the finger 82 at each side, whereby the finger and the shaft 81 will move with the carrier rod until stopped by a nut 9^a, the shaft being slidably mounted in nuts 9^a, 9^a, to permit endwise reciprocation of said shaft.

Fig. 5 shows two of the abutment screws backed off into idle position away from finger 82. Fig. 4, similarly shows a screw in full lines and another screw in dotted lines on the adjacent rod back of the finger 82. Fig. 1, shows two abutment screws on the same rod in operative position for engagement with the finger. Similar abutment screws on one or more other splicing yarn carrier rods enable me to secure them also to finger 82 for reciprocation with shaft 81 to the extent permitted by nuts 9^a, 9^a. The screw 11^a has an end extension 20^a fixedly

carrying oppositely toothed ratchet wheels 21ª and 22ª, and loosely strung arms 23ª and 24ª carrying spring controlled pawls 25ª and 26ª adapted to engage the respective ratchet wheels 21ª and 22ª, a notched rim and locking pin being employed as usual to prevent the accidental turning of the shaft 11ª. A pattern control chain 50ª hereinafter fully described, determines the [illegible] ment of the pawls, and the actuation of the connecting links 27ª and 28ª which are respectively connected to the loose arms 23ª and 24ª at their upper ends and to the levers 29ª and 29ª at their lower ends. These levers are pivoted at their forward ends to the main frame 1ª of the machine, and carry the rollers 30ª and 31ª, said rollers having a limited longitudinal movement on their respective lever carrier studs 32ª and 33ª and being adapted to ride upon special cams on the cam shaft 5ª, said cams having idle paths 34ª and 35ª and active paths 34ª and 35ª for the respective rollers all as in the form first described. Arms 40ª and 41ª are forked at one end and engage the rollers 30ª and 31ª respectively, and their opposite ends are attached to a horizontal shaft 42ª which extends practically the entire length of the machine. When motion is applied to the shaft 42ª by spring 43ª (Fig. 1) the arms 40ª and 41ª are caused to move and therewith the rollers 30ª and 31ª upon their respective lever carrier studs 32ª and 33ª from the idle paths of the cams on shaft 5ª to their operative paths 34ª and 35ª. A cam 45ª mounted on cam shaft 5ª, acting through the medium of a bell crank 44ª, returns the rod 42ª to the position shown in Fig. 1.

To automatically control the movement of this shaft 42ª, I employ the pattern chain 50ª, to which a step-by-step motion is imparted from cam shaft 5ª, through cam 51ª, and link connected lever 52ª, the latter having a pawl 53ª acting on the ratchet teeth of chain supporting wheel 54ª. Studs 55ª on the chain 50ª are adapted to act upon the lever 56ª carrying a shaft latch-member 57ª to raise and lower the latch. This latch 57ª slidably bears against a fixed shaft supporting bracket 58ª, and when in its lower position engages with its widest part between said bracket and a collar 59ª fixed on the shaft 42ª to temporarily hold the arms 40ª and 41ª in such position as to cause the rollers 30ª and 31ª to ride upon the idle portion of their respective cams, and when in its raised position the narrow lower end of the latch allows the shaft to move to the left to permit the said rollers to ride upon the active paths of the cams.

The raising of the lever 56ª and therewith the latch member 57ª is caused by the studs 55ª passing beneath the said lever. These studs are adjustable upon the pattern chain 50ª and the number of them controls the number of partial rotations of the screw shaft 11ª in one direction, while the distance between them controls the time between spindle movements and hence the distance between changes in the width of the ornamentation.

In order to impart movement to the screw shaft 11ª in a reverse direction, I employ a second set of studs 55ª mounted on the pattern chain 50ª [illegible] a latch 57ª hung from a lever 56ª. This latch 57ª is like latch 57ª and acts upon a shaft 42ª in like manner to the action of latch 57ª on shaft 42ª. Motion is imparted to the shaft 42ª by the small bell crank movement 44ª which imparts motion to the shaft 42ª, the shaft 42ª abutting against a bracket on shaft 42ª (Fig. 1) for this purpose. A shaft 83 (Figs. 1 and 3) extends across the machine from front to rear and carries on one end thereof an arm 84 having a forked end 85 straddling a pin 86 fixed to the shaft 42ª (see Fig. 1). A spring 43ª tends to move shaft 42ª to the left, holding it against latch 57ª or bracket 42′ on shaft 42ª. Studs 55ª and 55ª can be mounted side by side so as to cause both of the preceding described mechanisms to operate in unison or studs 55ª may be mounted so as to cause lever 56ª and therewith arm 57ª to operate independently, in which case a partial rotation of the shaft 83 is caused through the engagement of the forked arm 84 with the pin 86 on shaft 42ª. The opposite end of this shaft 83 carries a cross arm connection 87 (see Fig. 2) the outer ends of which are connected to the rods 88 and 89 and the upper ends of which are connected to pawl lifters 90 and 91 respectively. These pawl lifters engage slidably with studs fixedly mounted in the pawls 25ª and 26ª, and when in one position permit the engagement of the pawl 25ª with the ratchet 21ª at the same time holding out of action the pawl 26ª by preventing its engagement with the ratchet 22ª, and when in the reverse position permit the engagement of the pawl 26ª with the ratchet 22ª, and at the same time hold out of action the pawl 25ª from engagement with the ratchet 21.

The ratchet 21 is toothed so as to be engaged by the pawl 25ª which is hooked and operates upon its down stroke turning the screw shaft 11ª in a clockwise direction and moving the nuts 9ª toward each other, while the ratchet 22ª is toothed so as to be engaged by the pawl 26ª, which operates upon its up stroke, moving the shaft 11ª in a counter clockwise direction and therewith the nuts 9ª away from each other.

Carried upon the supporting shaft 81, which is supported in the nuts 9ª, 9ª, is the stop finger 82 which is brought manually into the path of the stops 7ª, 7ª (see Fig. 4) when it is desired to limit the movement of the thread carriers by the means described.

During the narrowing operation (i. e., the

shaping of the leg portion of the stocking) it is essential that the mechanism controlling the design be held out of action, and in order to accomplish this, I employ a stop device similar to that shown at 57ª Fig. 1 and operating upon the same shaft 42ª.

Mounted on a stud 93 adjacent the main cam shaft 5ª is the usual lever cam 90 which controls the narrowing mechanism, and attached thereto is an arm 92 (Figs. 6 and 7) which when the lever cam goes into action moves in the direction of the arrow (Fig. 6) against the collar 93 moving therewith the shaft 94 and the block 95 attached to the end thereof, into the path of travel of the collar 96 fixed to the shaft 42ª and prevents the shaft from being shifted to the left by spring 43ª. It will thus be seen that during the narrowing of the stocking the shaft 42ª which controls the operation of the design mechanism is prevented from working. A spring 97 tends to draw rod 94 toward the rear of the machine and so to normally hold the block 95 out of the path of collar 96.

The purpose of preventing operation of the screw-actuating means during narrowing arises out of the fact that if such means should happen to operate during narrowing the sinkers would cut off the yarns at the fabric and so cause press-offs and seconds.

It will be obvious to those skilled in the art that various modifications may be made in my device without departing from the spirit of the invention and therefore I do not limit myself to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a straight knitting machine, reciprocating yarn guide carrier rods, a finger supported independently of said yarn guide carrier rods said finger being adapted to be connected to one or more yarn guide carrier rods to reciprocate therewith, and stops arranged to limit the movement of the finger in opposite directions.

2. A device as in claim 1, combined with means for moving the stops simultaneously toward or from each other.

3. A device as in claim 1, combined with pattern-controlled means for moving the stops simultaneously toward or from each other.

4. A device as in claim 1, combined with pattern-controlled means for moving the stops simultaneously toward or from each other, said pattern-controlled means controlling both the time and the direction of movement of the stops.

5. A device as in claim 1, combined with pattern-controlled means for moving the stops simultaneously toward or from each other, and means for preventing operation of said means during the narrowing operation.

6. In a straight knitting machine, reciprocating yarn guide carrier rods, a finger supported independently of the yarn guide carrier rods said finger being adapted to be connected to one or more yarn guide carrier rods to reciprocate therewith, stops arranged to limit the movement of the finger in opposite directions, and a reversely threaded spindle connected to said stops for moving them toward or from each other.

7. A device as in claim 6, combined with pattern-controlled means for rotating said spindle.

8. A device as in claim 6, combined with pattern-controlled means for rotating said spindle, said pattern-controlled means controlling both the direction and the time of rotation of the spindle.

9. A device as in claim 6, combined with pattern-controlled means for rotating said spindle, and means for preventing rotation of said spindle during the narrowing operation.

10. In a straight knitting machine, reciprocating yarn-carrier rods, a pair of stops, means for moving the stops toward or from each other, a reciprocatory shaft carried by said stops and having its endwise movement limited by said stops, and means for connecting said shaft to one or more of said carrier rods.

11. A device as in claim 10, the stop-moving means being pattern-controlled to determine the direction and the time of such movement.

12. A device as in claim 10, the stop-moving means being pattern-controlled to determine the direction and the time of such movement, and means to prevent movement of the stops during the narrowing operation.

13. A device as in claim 10, the stop-moving means being pattern-controlled to determine the direction and the time of such movement, and means to prevent movement of the stops during the narrowing operation said last-named means being pattern-controlled.

14. In a straight knitting machine, reciprocating yarn guide carrier rods, a pair of stops, a reversely threaded spindle connected to said rods for moving them simultaneously toward or from each other, a reciprocatory shaft carried by said stops and having its endwise movement limited by said stops, and means for connecting said shaft to one or more of said carrier rods.

15. In a straight knitting machine, reciprocating yarn guide carrier rods, a pair of stops, reversely threaded spindle connected to said rods for moving them simultaneously toward or from each other, a reciprocatory shaft carried by said stops and having its endwise movement limited by said stops,

means for connecting said shaft to one or more of said carrier rods, means for rotating said spindle, and a single pattern chain controlling both the times and the direction of rotation of the spindle.

In testimony whereof I affix my signature.

RICHARD E. SCHLETTER.

DEFENDANT'S EXHIBIT H

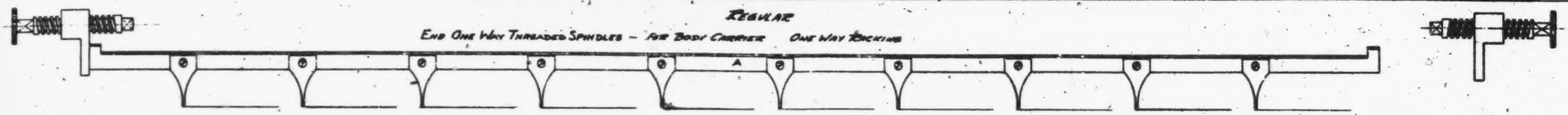
600
Sheet 1

Prior Arts Spindles and Carrier's

1

Regular

End One Way Threaded Spindles – For Body Carrier One Way Reciting



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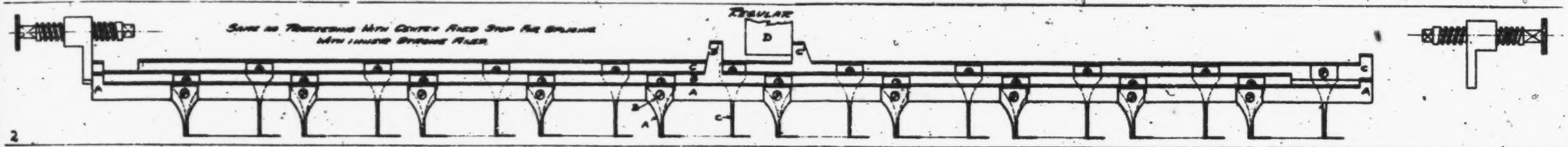
Same as Preceeding With Center Fixed Stop For Splicing With Limited Opening Allen

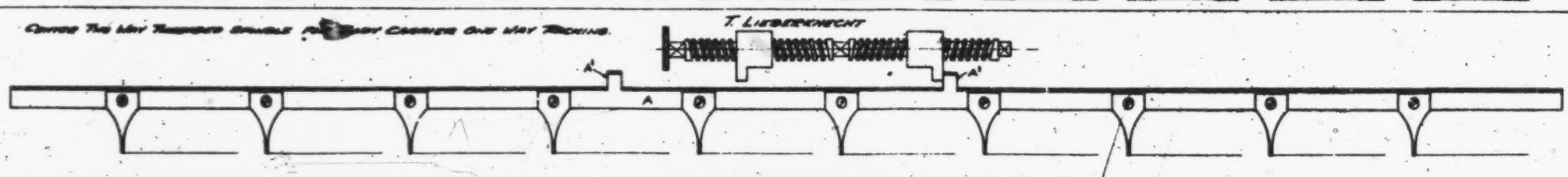
Regular



3

Center Two Way Threaded Spindle For Body Carrier One Way Reciting

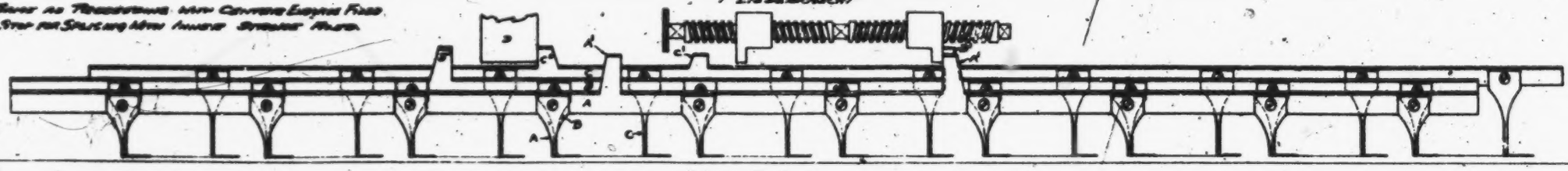
T. Liebenecht



4

Same as Preceeding With Center Eccentric Fixed Stop For Splicing With Limited Opening Allen

T. Liebenecht



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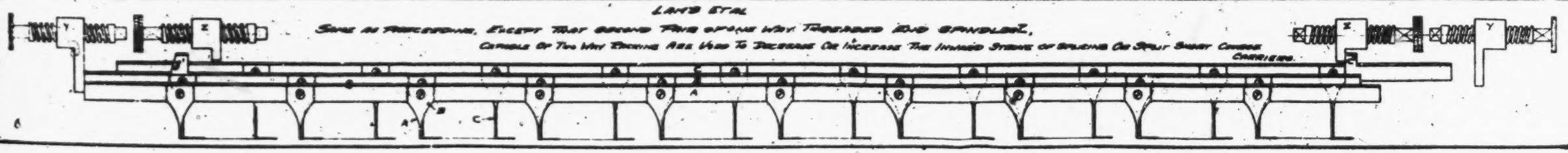
Lamb Et Al

Two Way Threaded Spindles For Body Carrier One Way Reciting With Solid Fixed or One Way Threaded End Spindles Z Capable of Two Way Reciting.

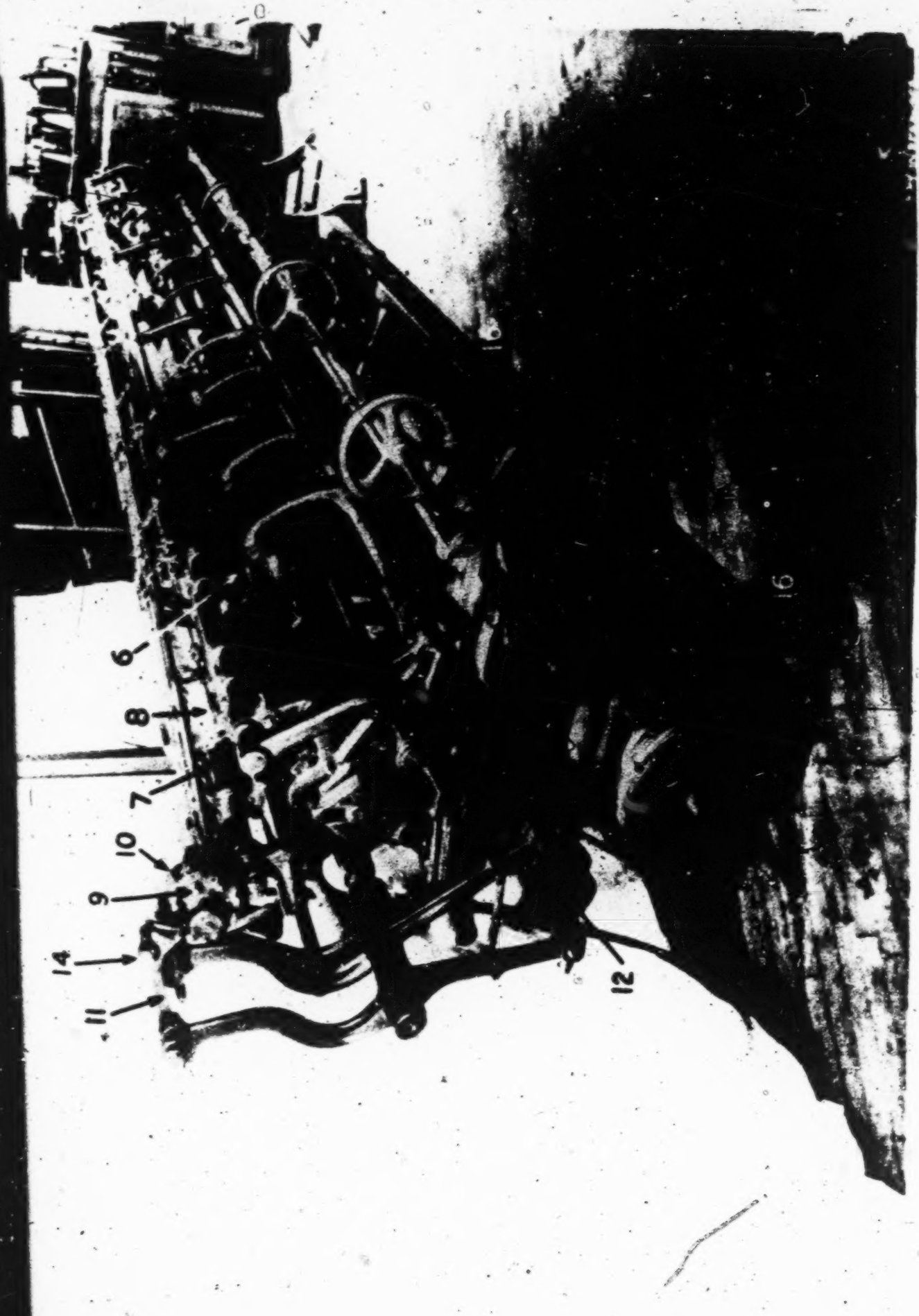
6

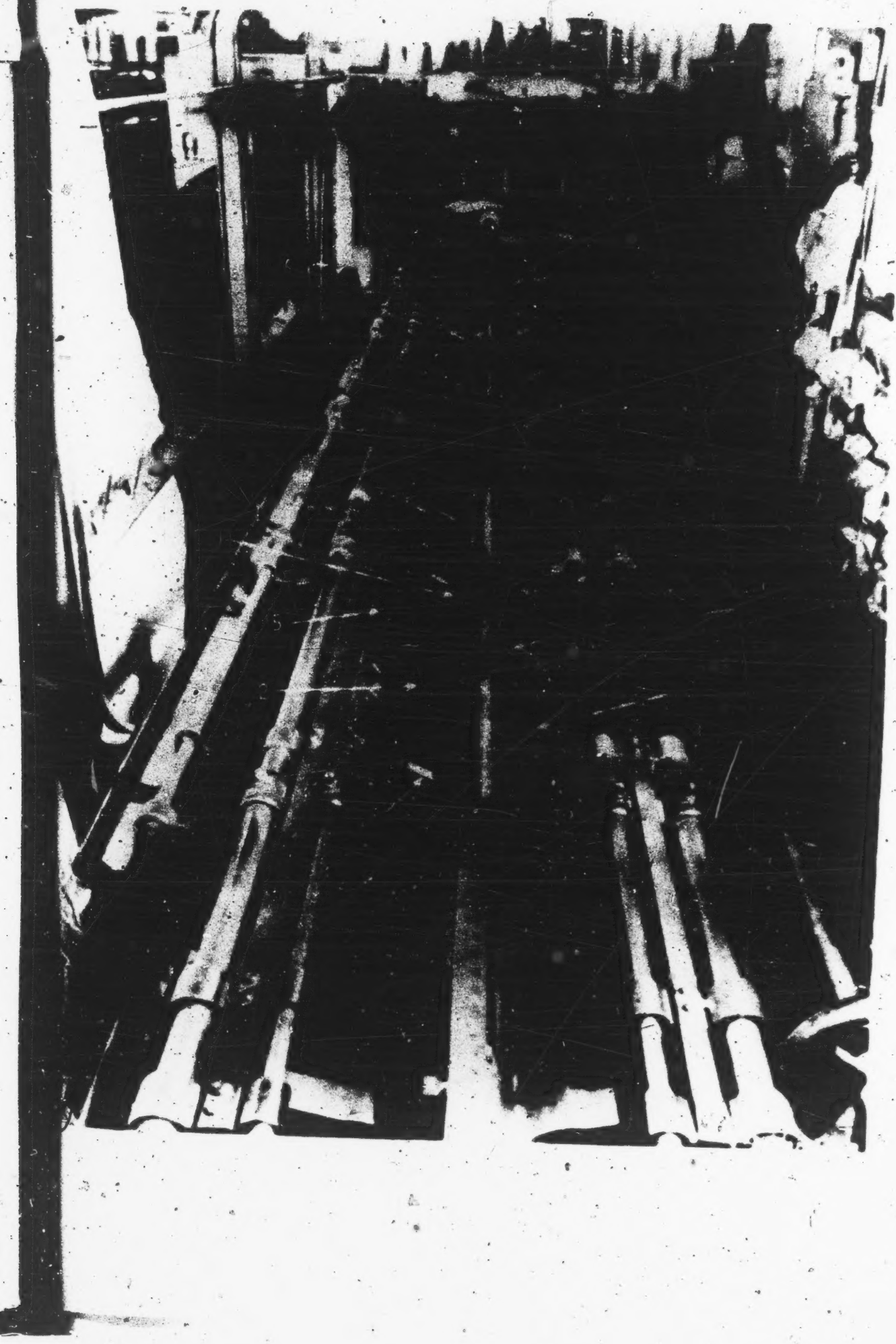
Lamb Et Al

Same as Preceeding, Except That Second Five of One Way Threaded End Spindles Z, Capable Of Two Way Reciting Are Used To Decrease Or Increase The Limited Opening of Splicing Or Split Sheet Carrier Centerline.



[fols. 601-604] DEFENDANT'S EXHIBIT NO. 1





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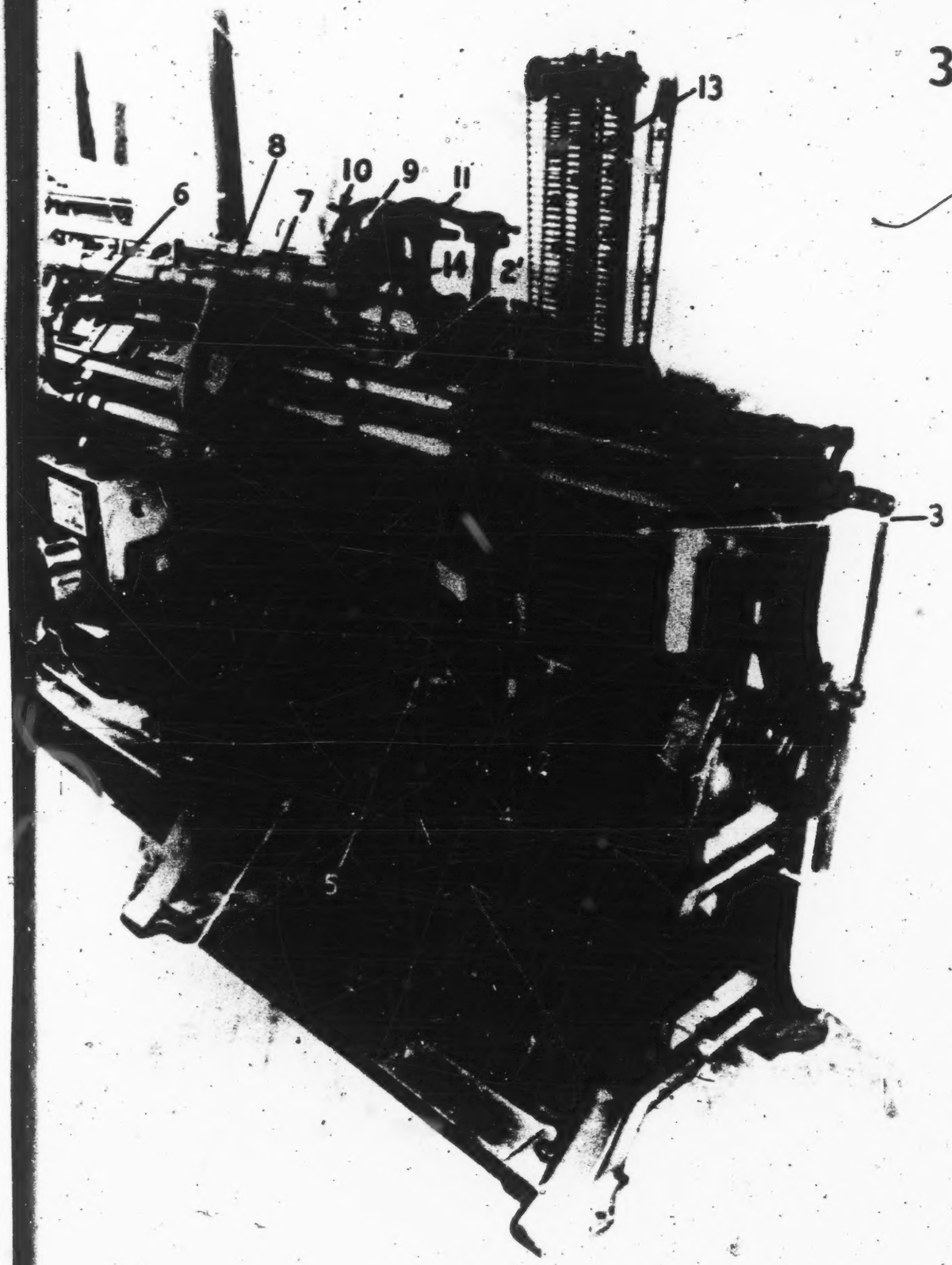

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DEFENDANT'S EXHIBIT L 605

May 21, 1929. R. E. SCHLETTER 1,713,628

ATTACHMENT FOR FLAT KNITTING MACHINES

Filed Nov. 5, 1925 4 Sheets-Sheet 1

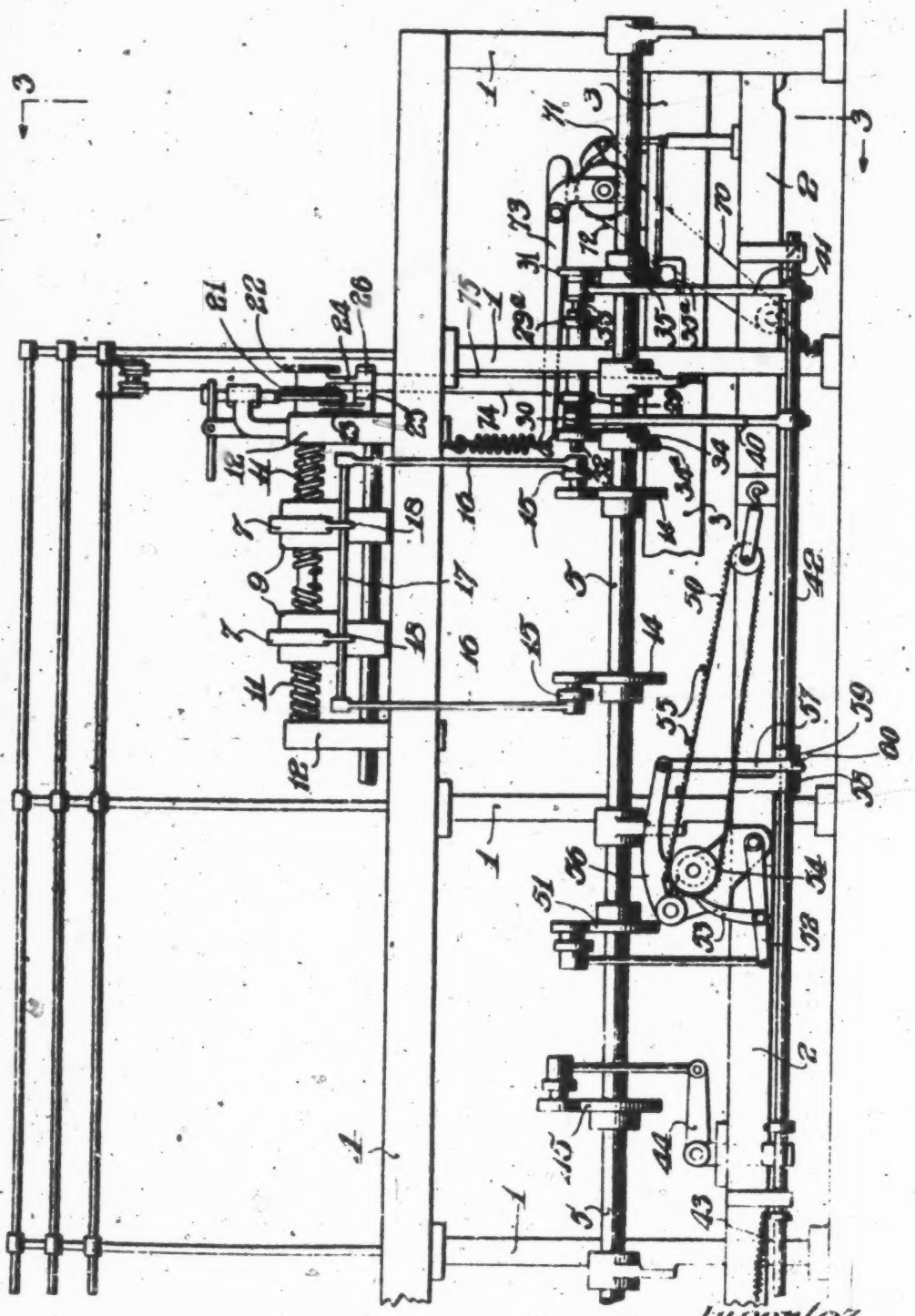

Fig. 1.

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ATTACHMENT FOR FLAT KNITTING MACHINES

Filed Nov. 5, 1925 4 Sheets-Sheet 2

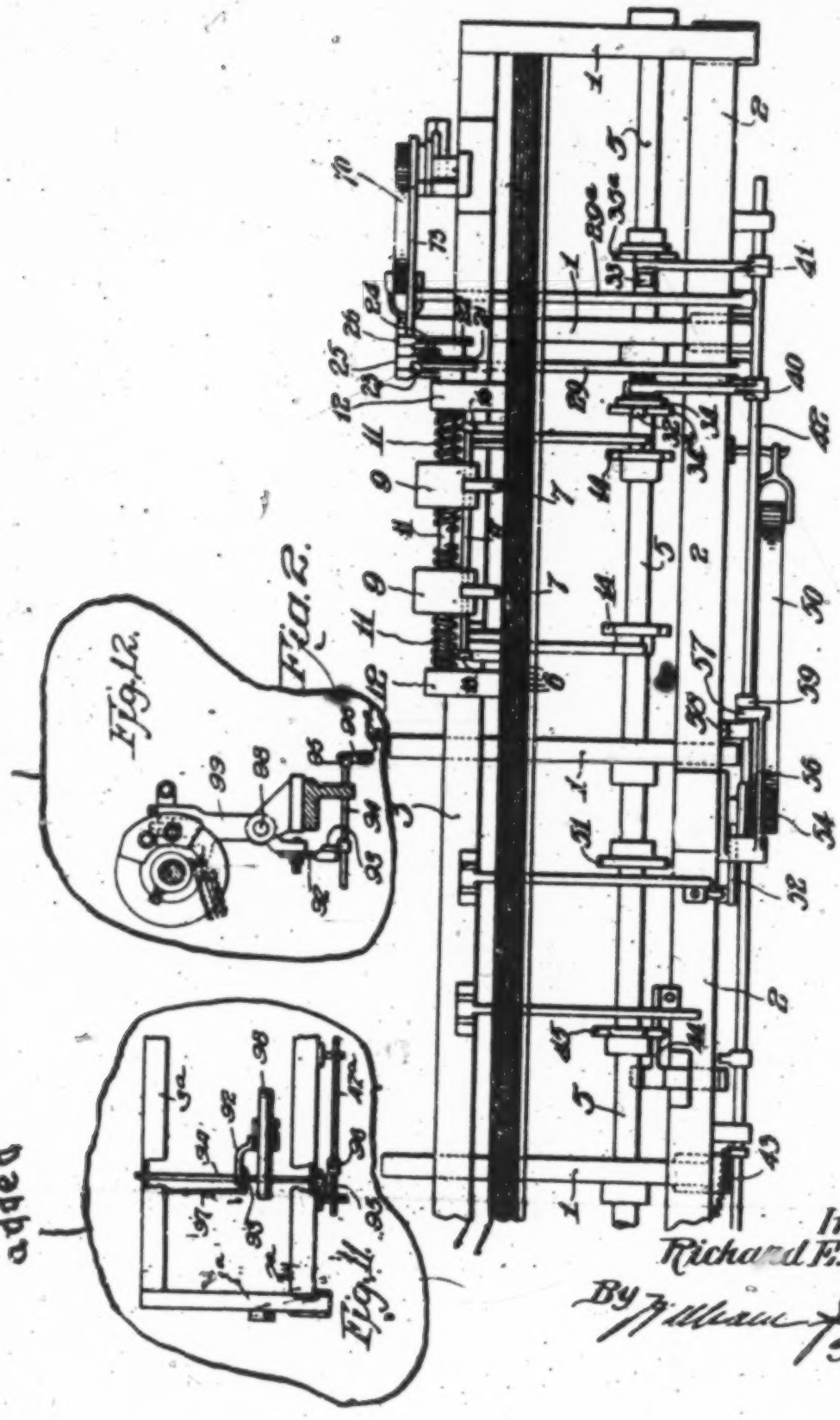

Fig. 12.

Fig. 11.

added

added

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May 21, 1929. R. E. SCHLETTER 1,713,628

ATTACHMENT FOR FLAT KNITTING MACHINES

Filed Nov. 5, 1925 4 Sheets-Sheet 3

Fig. 4.

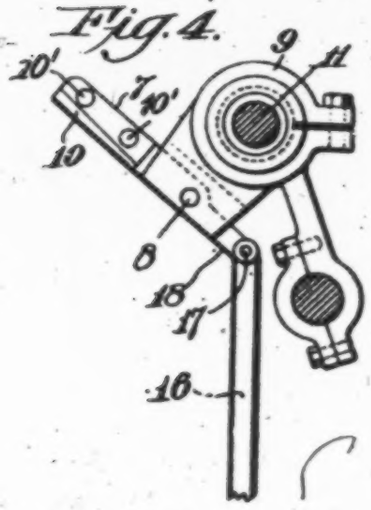


Fig. 3.

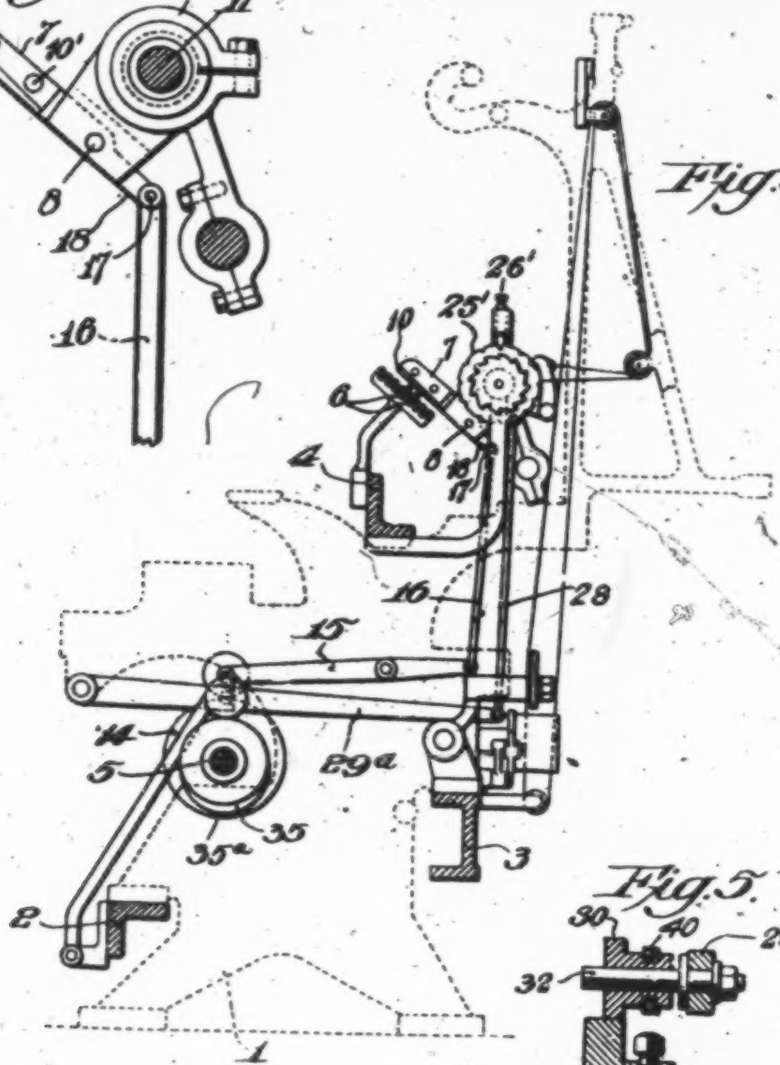
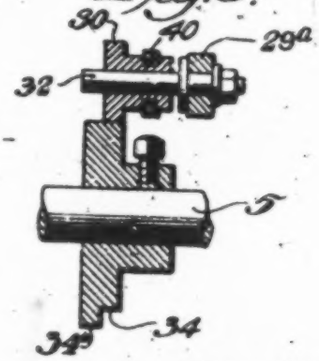


Fig. 5.



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ATTACHMENT FOR FLAT KNITTING MACHINES

Filed Nov. 5, 1925 4 Sheets-Sheet 4

Fig. 6.

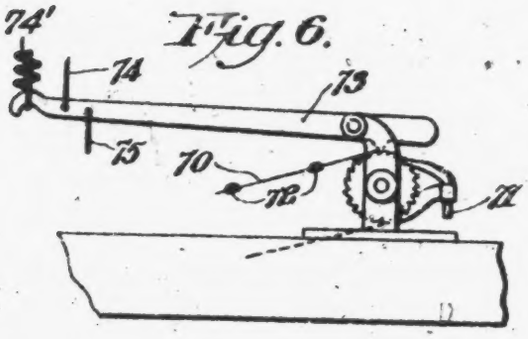


Fig. 7.

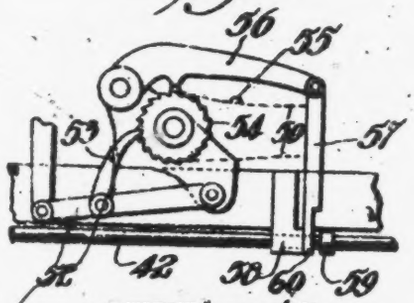


Fig. 10.

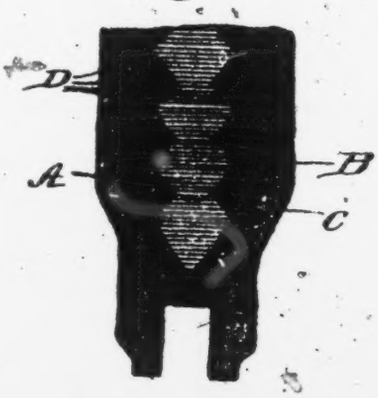


Fig. 8.

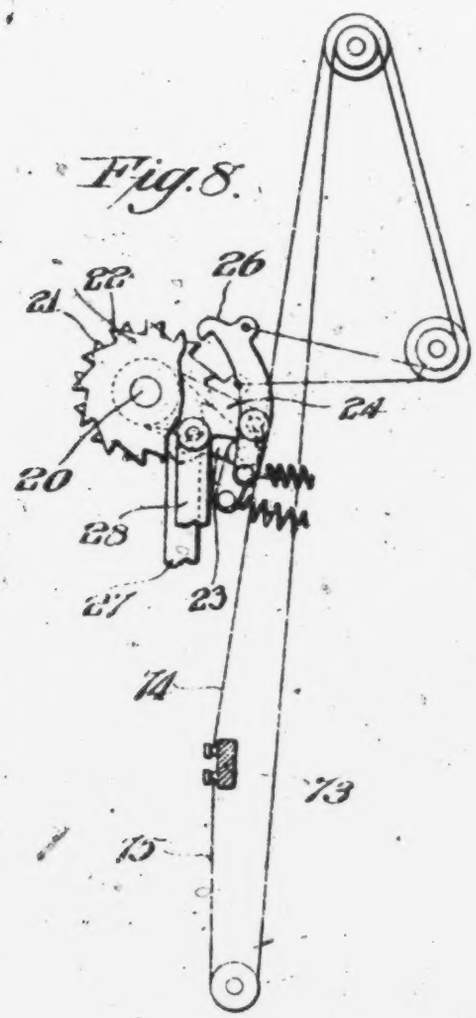
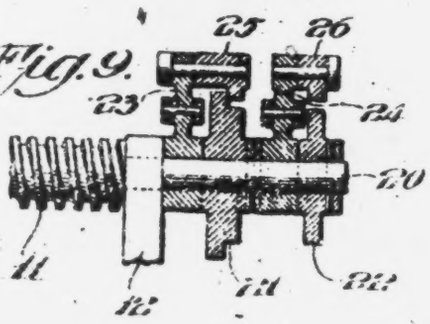


Fig. 9.



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By
William J. Jackson
Attorney.

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Patented May 21, 1929. 1,713,628

UNITED STATES PATENT OFFICE.

RICHARD E. SCHLETTER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SCHLETTER & SANDER, INC., OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF DELAWARE.

ATTACHMENT FOR FLAT-KNITTING MACHINES.

Substitute for abandoned application Serial No. 569,559, filed June 19, 1922. This application filed November 5, 1925. Serial No. 66,916.

This invention, generally stated, has relation to flat knitting machines for making hosiery of full fashioned type and has more particular relation to an attachment for fashioning designs, as clocks, upon said hosiery. This application is a substitute for my abandoned application No. 569,559 filed June 19, 1922.

Commercially considered, two types of clocked hosiery are in use. In one type clocks are of open work, termed clocklace, and stockings of this type, being relatively fragile, are not suited for all occasions or every-day use and furthermore are comparatively expensive. The other type comprises hosiery in which clocks are embroidered thereon. While this type is best suited for every-day use, practice dictates, that, the action of needles laying-on the embroidery yarn serves to so weaken the stocking-web as to have a deleterious effect thereon. The embroidering operation also serves to increase manufacturing costs.

It is an object of my invention to provide an attachment for full-fashioned knitting machines whereby yarn-guides can be accurately controlled to lay a yarn over a distance less than the full length of a course being knitted, as for reinforcing or for so-called split-seam work wherein sections of fabric are connected by suture seams. For this purpose I preferably employ opposed stops with conjoint controlling means arranged to move them toward or from each other incrementally, but any equivalent means or devices may be employed which will effect the purpose of the invention.

A further object of the present invention is to provide an arrangement, connection and combination of novel mechanical movements attached to a conventional flat knitting machine for attaining the results sought by the leading object.

A further object is to provide an attachment for a flat knitting machine in which is provided a plurality of thread-carrier rods, stop-mechanism for said rods comprising a shaft including a screw having reversely-threaded portions carrying oppositely movable split-seam stops, means for moving said stops from and toward the rods to effect the split-seam interlooping of adjacent yarn-sections, means including a pattern chain and reversely-acting pawls for intermittently actuating said screw in successive courses, and separate means for selectively engaging said pawls.

A still further object is to provide an attachment for a flat knitting machine in which is provided a plurality of thread-carrier rods, stop-mechanism for said rods comprising a shaft including a screw, having reversely threaded portions carrying oppositely disposed stops, operating means for moving said stops from and toward the rods to limit variably the stroke of the yarn carrier rods, means including a pattern-chain and oppositely-acting pawls for intermittently rotating said screw in successive courses, and means including a separate pattern-chain for selectively engaging one of said pawls.

Other and further objects not at this time appearing will be hereinafter referred to.

The invention consists of the novel construction herein described and finally claimed.

The nature, characteristic features and scope of the invention will be more fully understood from the following description taken in connection with the accompanying drawings forming part hereof, and in which:

Fig. 1, is a view in front elevation of a portion of one type of full-fashioned knitting machine known as the "Cotton" machine with an attachment of the invention applied thereto, machine parts not essential to the invention being omitted.

Fig. 2, is a plan view thereof.

Fig. 3, is a sectional elevation, taken on the line 3—3 of Fig. 1, the machine frame outline being indicated in dotted lines.

Fig. 4, is an enlarged end view of the stop employed.

Fig. 5, is an enlarged cross-sectional view of the special form of cam employed for intermittently rotating the clock forming or split-seam screw that operates the stops.

Figs. 6 and 7 are fragmentary views illustrating the two pattern chain mechanisms for automatically controlling the movements of the clock forming or split-seam screw.

Fig. 8, is a view of the selective control means for engaging the reversely acting pawls;

Fig. 9, is a cross sectional showing of the pawl and ratchet mounting on the screw shaft.

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Fig. 10, indicates one form of stocking fabric having yarn sections with inclined clock or split-seam border line ornamentation as made by means of my attachment; and

Figures 11 and 12, details of means preventing operation of my device simultaneously with a narrowing stop.

For the purpose of illustrating my invention I have shown in the accompanying drawings two forms thereof which are at present preferred by me, since the same have been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of the instrumentalities as herein shown and described.

In practice a web of hosiery is knit upon a straight knitting machine equipped with the novel mechanism of the present invention which mechanism is capable of co-acting with respect to the web-forming needles to provide clocks or other ornamental re-inforcements which may be ornamental or useful or both, said reinforcements having zig-zag-like lines inclined to the wales and courses of the web. An example of such stocking re-inforcement, other than that shown in Fig. 10, is disclosed in letters patent granted to me under date of March 31, 1925, and numbered 1,531,349 wherein the clocks are made by a splicing yarn instead of by split-seam work. In manufacture, the stocking-web, which has selvage edges, may be knit with a main yarn in a well understood manner to that portion of the leg at which the narrowing operation takes place. At or about the time narrowing of the leg portion is commenced, additional or re-inforcing thread is presented to certain of the web-forming needles to effect formation of a clock or clocks. During formation of a clock or clocks it is to be understood that fabrication of the stocking-web, including the re-inforced heel portions, takes place in the usual and well understood manner of making full fashioned hosiery. The additional or re-inforcing thread is supplied to the web-forming needles so that zig-zag-like lines, inclined to the wales and courses of the web, are produced to effect the contour of a clock or clocks. Obviously, depending upon the contour of a clock or clocks desired, the feeding of additional thread varies. In practice I commence the formation of the clock or clocks midway of the narrowing portion of the web although obviously said formation may be started and stopped at other places and while but one clock may be formed upon a stocking-web, if desired, in practice two or more are preferred, the number being immaterial.

Referring now to the attachment for making a clock or other ornamentation, and referring more especially to Figs. 1 to 9 inclusive, the reference numeral 1 indicates the main frame of a flat knitting machine; 2, the front beam; 3, the back beam; 4, the center bed; and 5, the main cam shaft. Such machine may be of any well known full fashioned knitting machine type and to such my novel attachment is connected. These machines are commonly formed with a plurality of knitting sections, each of which is provided with the requisite number of yarn-guides, and the latter are mounted on longitudinally movable yarn carrier rods 6, 6, 6, 6, extending the full length of the machine and their joint movements controlled by rod-contacting stops, not shown, acting in well known manner at the ends of the machine. My invention, among other things, relates to special stops for these rods 6, 6, 6, 6, affecting the yarn-feed movements thereof, and for simplicity of showing I have indicated in the drawings only the rods themselves, it being understood that they carry thread guides and abutments such as shown in Figs. 11 and 12 and perform their usual functions as heretofore.

The special rod-stops 7, 7 (see Fig. 1) employed in my novel attachment, act in a manner similar to the action of the well known "Split-foot" stops heretofore employed in making split seam work, which stops however merely oscillated and did not travel lengthwise of the machine. In Figs. 3 and 4 of the drawings the stops are shown as having undercut portions at 10 which are desirable for split-seam work. My invention however is not limited to the use of these specific stops for this specific purpose but they may be used for all purposes for which stops are used. With the construction illustrated in Fig. 4 it is possible to produce split-seam stitches as in the "split-foot" stocking for uniting fabric sections by the delayed partial lifting of the stops, after the arrest of the rod movements, to allow additional movement of the rods determined by the depth of the undercut portions 10 (see Fig. 4) of said stops 7, 7, this additional movement occurring after the formation of the stitches of the course and forming floats of determined length extending into the next succeeding courses of knitting, the effect being to produce ornamental border line junction seams between fabric sections of the finished fabric.

Stops such as herein illustrated are used for making spliced or plated figures on a plain fabric and for split seam work, the split seam stops being undercut as in Fig. 4 and the others not undercut as in Fig. 16. It is new to control the stops by conjoint means for moving them toward or from each other to shorten or lengthen the stroke of the same guide at both ends.

Any conventional or desirable lugs, screws or other attachments may be located on the

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carrier rods for cooperating with the stops and no claim is made to such devices.

The special stop employed in my novel attachment and the mechanism for operating the same, as fully described hereinafter, provides for the introduction of this split seam anywhere in the length of the fabric, for its automatic control by pattern-chain mechanism, and for varying the spreading of said stops in successive courses to reversely incline said split-seam border lines to the wales for producing ornamental figuration of the fabric, such as clocks.

The stops 7, 7, as shown in the drawing are pivotally carried at 8, 8 in nuts 9, 9 (see Fig. 4) respectively non-rotatively mounted on the right and left threaded portions of a screw shaft 11, rotatably carried in fixed brackets 12, 12 intermediate the length of the machine, and rocking movement from and toward said carrier rods is imparted to said stops by cams 14, 14 on cam shaft 5, through levers 15, 15 operated thereby and connected by rods 16, 16 to a horizontal bar 17 slidably engaging in the rear extensions 18, 18 of the stops 7, 7; this rocking movement permitting the laying of the floats of the split-seam and the depth of the undercut portion 10 determining the number of needles over which the yarn floats, and rotary movement of the screw shaft 11 adjusting the position of said stops 7, 7 in opposite directions. The points where the abutments mounted on the carrier rods normally strike the stops 7—7 are indicated at 10', 10' (Fig. 4).

The screw shaft 11, as more clearly shown in Fig. 2, has an end extension 20 fixedly carrying oppositely toothed ratchet wheels 21 and 22, and loosely strung rockarms 23 and 24 carrying spring-pressed pawls 25 and 26 adapted to engage the respective ratchet wheels 21 and 22, a notched disk 25' (Figs. 3 and 12) and a detent 26' held yieldably in engagement with the disk in conventional manner, being preferably employed to prevent accidental turning movement of said shaft 11. In other words, the screw shaft 11 may be positively moved backward or forward by the ratchet wheels 21 and 22 but said shaft, by reason of the teeth upon said disk 25', is locked against accidental turning movement at all times. (See Figs. 1 and 3.) Pattern-control means, hereinafter fully described, determines the selective engagement of the pawls, and connecting links 27 and 28 (see Fig. 3) respectively connect the rockarms 23 and 24 (see Fig. 2) to actuating levers 29 and 29a. Rollers 30 and 31 (see Figs. 1 and 5) having a limited longitudinal movement on their respective lever-carrier studs 32 and 33, are adapted to ride upon special cams on cam shaft 5, said cams having idle paths 34 and 35 and active paths 34a and 35a for the respective rollers, (see Fig. 5) to cause intermittent rotation of the screw shaft 11 as desired. Arms 40 and 41 loosely engaging the hubs of rollers 30 and 31 and carried by horizontal shaft 42, jointly move said rollers across their respective idle cam faces 34 and 35, and a spring 43 tends to impart longitudinal movement to said shaft 42 in one direction, while a cam 45 on cam shaft 5, through bell crank 44, imparts return movement to said shaft.

To automatically control the movement of this shaft 42 and thereby control the intermittent rotation of screw shaft 11, I employ, as shown, a pattern chain 50, (see Figs. 1, 2 and 7) to which step-by-step movement is imparted from cam shaft 5 through cam 51 and link connected lever 52, (see Fig. 1) the latter having a pawl 53 acting on the ratchet teeth of chain supporting wheel 54. Studs 55 on said chain are adapted to act upon a lever 56, carrying a shaft latch-member 57, to raise and lower the latter. This latch 57, as best shown in Fig. 7, slidably bears against a fixed shaft-supporting bracket 58, and when in lowered position the wide part of the latch engages a collar 59 fixed on said shaft 42 to hold the shaft 42 and its arms in a position where the rollers 30 and 31 are on the idle faces 34 and 35 of the cams.

When a stud 55 on said chain 50 lifts lever 56 and its shaft latch member 57, the reduced lower end 60 of the latch permits the spring 43 to move said shaft until the rollers 30 and 31 ride on the active paths 34a, and 35a, of their respective cams. Upon the passing of the stud 55, the wide part of the latch member 57 will fall again into engagement with collar 59, when the shaft 42 is again moved to the right by action of cam-actuated bell crank 44. The number of studs 55 on chain 50 will determine the number of rotations of the screw-shaft 11 and the movement of the nuts 9—9, to shift the stops 7—7 controlled thereby, toward and from one another in a direction crosswise of the wales of the knitted fabric.

To cause selective engagement of the pawls 25 and 26 before referred to, and thereby determine the direction of rotation of screw-shaft 11, I preferably employ as shown, a second pattern chain 70, to which step-by-step movement is imparted by the operation of cam 35a on a lever carrying the paw 71 (Fig. 1) to impart movement to the ratchet wheel carrying the pattern chain aforesaid having studs 72 operating a spring-pressed lever 73 (Figs. 6 and 8). Wires 74 and 75 extending over suitable pulleys, connect the lever 73 to the respective spring-pressed pawls 25 and 26, so that the movement of said lever 73 (as determined by the presence or absence of a stud 72, causes one or the other pawl to engage with its respective ratchet wheel 21 or 22) to impart the desired direction of rotation to the screw 11 through the intermittently acting levers 29 and 29a which operate

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the respective pawls. A spring 74' holds the lever 73 in the position shown when no button 72 is acting on the downwardly projecting lug of the lever.

From the foregoing description it will be seen that the yarn-guide controlling stops employed in my novel attachment may be moved from and toward each other by direct cam shaft action to cooperate with the usual knitting mechanism in producing the desired spliced or split-seam ornamentation of the adjacent fabric sections, and their relative adjustment from and toward one another automatically controlled and intermittently effected in successive courses. My novel split-seam stops, it will be understood, are employed in producing fabrics having sections of separate yarns of which for illustrative purposes one type is shown in Fig. 10, or spliced areas as shown in my said patent. In the particular illustrative fabric shown in Fig. 10, three yarn carrier rods have been employed for making a split seam fabric, each having a yarn guide supplying yarn only to its respective section A, B, or C, and my oppositely movable split seam stops have caused the interlooping of these yarn sections to form the reversely inclined split seam border lines D.

Each of the carrier bars for sections A and C is stopped on its outward movement by the conventional end stops at the ends of the machine and on its return movement by a stop 7. The carrier rod for section B has an abutment or abutments moving between stops 7, 7 and striking against one or the other at the ends of its throw. It would also be possible to provide abutments on this last-named rod outside the stops so as to strike alternately against the outer faces of the stops. Additional sections could readily be provided for by equipping differently located abutments so that the travel of the guides would cover different vertical stripes or yarns of the fabric.

Mounted on a stud 98 adjacent the main cam shaft 5ª is the usual lever cam 92 which controls the narrowing mechanism, and attached thereto, is an arm 92 (Figs. 11 and 12) which when the lever cam goes into action moves in the direction of the arrow (Fig. 11) against the collar 93 moving therewith the shaft 94 and the block 95 attached to the end thereof, into the path of travel of the collar 96 fixed to the shaft 42ª and prevents same from operating. It will thus be seen that during the narrowing of the stocking the shaft 42ª which governs the operation of the design mechanism is prevented from working. A spring 97 tends to normally hold the block 95 out of the path of collar 96.

The purpose of preventing operation of the screw-actuating means at this time arises out of the fact that if such means should happen to operate during narrowing the sinkers would cut off the yarns at the fabric and so cause press-offs and seconds.

What I claim is:

1. In a straight knitting machine having cooperating yarn guide carrier bars, a pair of opposed stops for certain of said carrier bars which have a stroke less than the full width of the fabric being knitted, and a reversely threaded spindle for moving said stops toward and from each other to vary the stroke of the bars controlled by said stops.

2. In a straight knitting machine having cooperating reciprocatory yarn guide carrier bars, a reversely threaded spindle, stops connected to the spindle positioned to limit the traverse of certain of the cooperating carrier bars to less than the full width of the cloth being knitted, and pattern controlled means for turning said spindle to vary the distance between said stops.

3. A device as in claim 2, said pattern controlled means being constructed and arranged to turn said spindle either to increase or to decrease the distance between said stops.

4. In a straight knitting machine, yarn guide carrier bars having a stroke less than the full width of the fabric being knitted, abutments on said carrier bars, a reversely threaded spindle, opposed stops for engagement by said abutments, said stops being operated by the reversely arranged threads of said spindle to vary the distance between them, and pattern controlled means for rotating said spindle.

5. In a straight knitting machine having guides for one or more yarns knitted in for less than the full length of a course, the combination of carrier bars for said guides, a reversely threaded spindle parallel to said bars, stops in the path of said abutments said stops being connected to the reversely threaded parts of said spindle, and pattern controlled means for rotating said spindle to vary the distance between said abutments.

6. In a straight knitting machine, yarn guide carrier bars including one or more bars having a stroke less than the full width of the fabric being knitted, abutments on said carrier bars, a reversely threaded spindle, opposed stops supported on the reversely threaded portions of said spindle for engagement by said abutments, and means for rotating said spindle.

7. In a straight knitting machine having reciprocating yarn guide carrier bars, a reversely threaded spindle, stops connected to the spindle positioned to limit the traverse of certain carrier bars, pattern controlled means for turning said spindle, and means for preventing operation of said means during the narrowing operation.

8. In a straight knitting machine having reciprocating yarn guide carrier bars, a reversely threaded spindle, stops connected to

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the spindle positioned to limit the traverse of certain carrier bars to a distance less than the width of the fabric being knitted, pattern controlled means for turning said spindle in either direction, and means for preventing operation of said means during the narrowing operation.

9. In a straight knitting machine, a set of yarn guide carrier bars, stops for said bars said stops having undercut portions normally out of operative relation to said bars, means for moving said stops toward and from each other, and means to move the stops so as to bring the undercut portions into operative relation to said bars, thereby permitting delayed additional movement of said bars.

10. In a straight knitting machine, a set of yarn guide carrier bars, pivoted stops for said bars said stops having undercut portions, means whereby the stops may be caused to approach or recede from each other, and pattern-controlled means to tilt the stops to bring the undercut portions into operative relation to said bars, thereby permitting delayed additional movement of said bars.

11. In a straight knitting machine, a set of yarn guide carrier bars, a reversely threaded spindle parallel to said bars, nuts on the reversely threaded portions of said spindle, stops operated by said nuts for limiting the movement of said carrier bars said stops having undercut portions, pattern controlled means for rotating the spindle to vary the distance between the stops, and means for moving the stops so as to bring the undercut portions into operative relation to said bars thereby permitting delayed additional movement of said bars.

12. In a straight knitting machine, a set of yarn guide carrier bars including one or more bars having a traverse less than the width of the fabric being knitted, a threaded spindle, a stop for limiting the traverse of a carrier bar in one direction said stop having an undercut portion, and being connected to said spindle, means for turning the spindle to move the stop lengthwise of the bar to vary the traverse of the bar, and means for moving the stop to bring the undercut portion into operative relation to said bar to permit delayed additional movement of the bar.

13. In a straight knitting machine, a set of yarn guide carrier bars including one or more bars having a traverse less than the width of the fabric being knitted, a threaded spindle, a nut on the spindle, a stop pivotally supported by the nut for limiting the traverse of a carrier bar in one direction said stop having an undercut portion, means for turning the spindle to move the stop lengthwise of the bar to vary the traverse of the bar, and means for moving the stop on its pivot to bring the undercut portion into operative relation to said bar to permit delayed additional movement of the bar.

14. In a straight knitting machine, a set of yarn guide carrier bars for operating yarn guides traveling less than the full width of the fabric being knitted, a spindle having reversed screw threads, stops operated by said spindle, means for turning the spindle in either direction, pattern-controlled means for determining the time of operation of the spindle, and pattern-controlled means for determining the direction of rotation of the spindle.

15. In a straight knitting machine, a set of reciprocating yarn guide carrier bars including bars having a stroke less than the width of the fabric being knitted, pair of stops for said guides, a reversely threaded spindle extending lengthwise of the machine, the respective stops being connected to the reversely threaded portion of the spindle for moving the stops simultaneously toward and from each other, pattern controlled means for determining the time for such movement, and correlated pattern controlled means for independently determining the direction of such movement.

16. In a straight knitting machine having a main cam shaft, a set of yarn guide carrier bars, a spindle having reversed screw threads, stops connected to said spindle said stops limiting the travel of the carrier bars, means for turning the spindle in either direction, pattern-controlled means for determining the time of operation of the spindle including a rod extending lengthwise of the machine, connections from the main cam shaft for moving the rod in one direction, a detent for holding the rod, and means including a pattern chain for releasing the detent to permit the rod to return.

17. In a straight knitting machine, a set of yarn guide carrier bars, a spindle having reversed screw threads, stops connected to the spindle said stops limiting the travel of said carrier bars, reversible pawl and ratchet means for turning the spindle, pattern-controlled means for determining the time of operation of the spindle including a rod extending lengthwise of the machine, connections from the main cam shaft for moving the rod in one direction, a detent for holding it, means including a pattern chain for releasing the detent to permit the rod to return, means for determining the direction of rotation of the spindle including a second rod paraliel to the first, means on the first rod for moving the second in one direction, a detent for holding the second rod, and connections from said pattern chain for releasing the second rod.

18. In a straight knitting machine having cooperating yarn guide carrier bars, a pair of opposed stops for a carrier bar having a stroke less than the full width of the fabric being knitted, and a rod-like element having

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means to move said stops toward and from each other longitudinally of said element and to hold said stops at various distances from each other.

19. In a straight knitting machine having cooperating yarn guide carrier bars, means for making a fabric with sections connected by suture seams including a pair of opposed stops for a carrier bar supplying yarn to one of said sections, and a reversely threaded spindle for moving said stops toward and from each other to vary the stroke of said bar.

20. In a straight knitting machine having cooperating reciprocatory yarn guide carrier bars, means for knitting a fabric with sections connected by suture seams including a reversely threaded spindle, stops connected to the spindle positioned to limit the travel of a carrier bar supplying yarn to one of such sections, and pattern controlled means for turning the spindle to increase or decrease the distance between said stops.

21. In a straight knitting machine having cooperating yarn guide carrier bars, means for knitting a fabric with sections connected by suture seams including a pair of opposed stops for a carrier bar supplying yarn to one such section, and a rod-like element carrying the stops, and means to move said stops toward and from each other longitudinally of said element and to hold said stops at various distances from each other.

22. In a full fashioned knitting machine comprising a plurality of thread-carrier rods, stop-mechanism for said rods comprising a pair of oppositely traversing split-seam stops which at every step of traverse move toward or away from each other, means for moving said stops from and towards the rods to effect the split-seam interlooping of adjacent fabric sections, and means for intermittently moving said stops to reversely incline the split-seams to the lines of the wales.

23. In a full fashioned knitting machine comprising a plurality of thread-carrier rods, stop-mechanism for said rods comprising a screw shaft having reversely-threaded portions carrying oppositely movable split-seam stops adapted to control the split-seam interlooping of adjacent fabric sections, and means for intermittently actuating said screw in successive courses to reversely incline the split-seams to the lines of the wales.

In testimony whereof, I have hereunto signed my name.

RICHARD E. SCHLETTER.

DEFENDANT'S STRUCTURE

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CLOCKWISE RACKING WITH TOP PAWL MOVES STOP-NUTS APART TO WIDEN SELVAGE PORTIONS AND ALSO PULLS BACK STOP PINS UP.

COUNTER CLOCKWISE RACKING WITH BOTTOM PAWL MOVES STOP-NUTS TOWARD EACHOTHER TO NARROW SELVAGE PORTIONS AND ALSO PULLS FRONT STOP PINS UP.

BACK STOP PIN LIFT ROD

FRONT STOP PIN LIFT ROD

BACK STOP PINS

FRONT STOP PINS

CARRIERS 2, 5, 6

TOP PAWL CLOCKWISE RACKING

FINISH OF RACKING

STOPS MOVED OUTWARDLY

BACK PINS LIFTED

START OF RACKING

BOTTOM PAWL COUNTER CLOCKWISE RACKING

FINISH OF RACKING

STOPS MOVED INWARDLY

FRONT PINS LIFTED

START OF RACKING

DEFENDANT'S EXHIBIT M 615

DEF. EX. M p. 2

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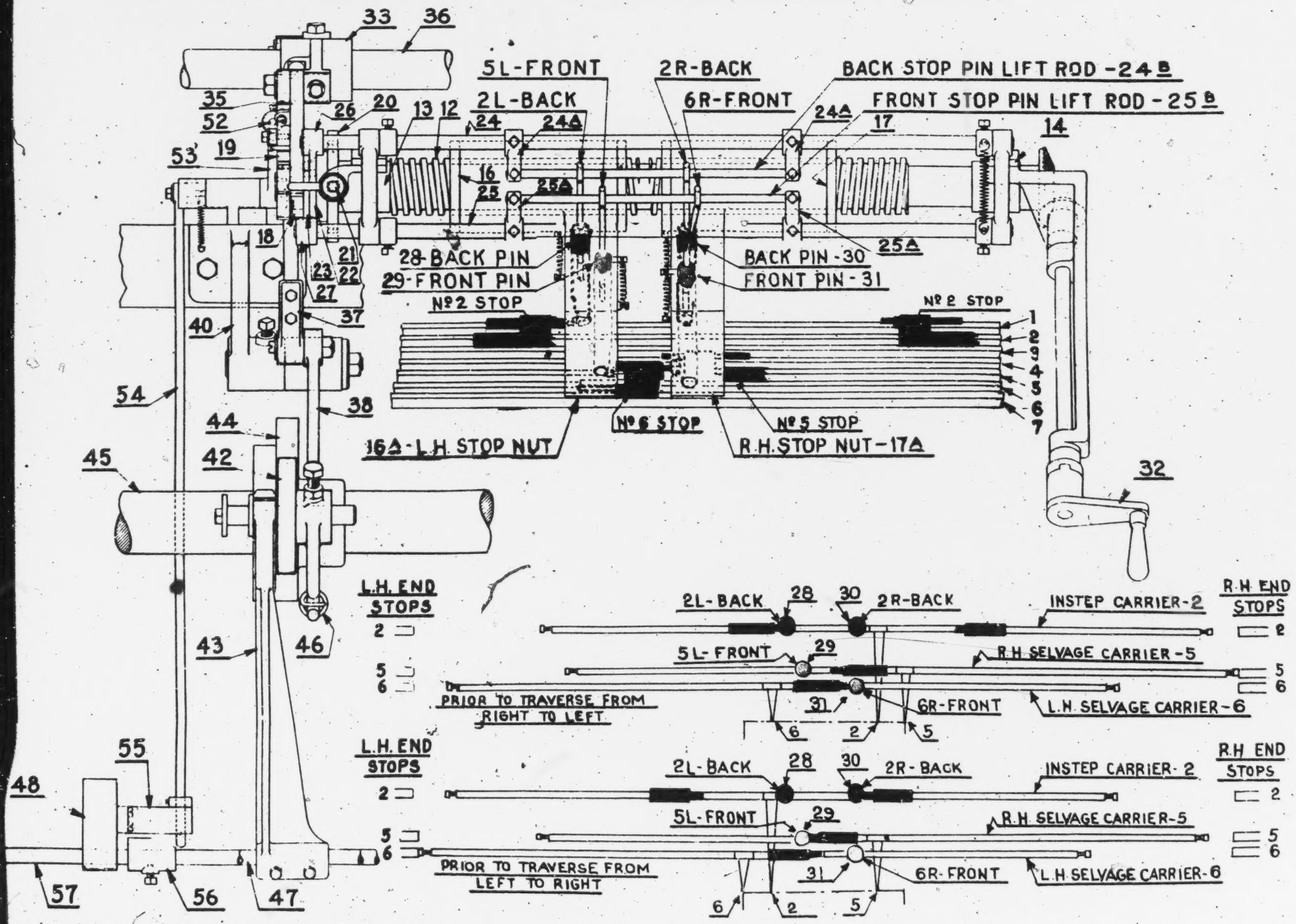
(2)

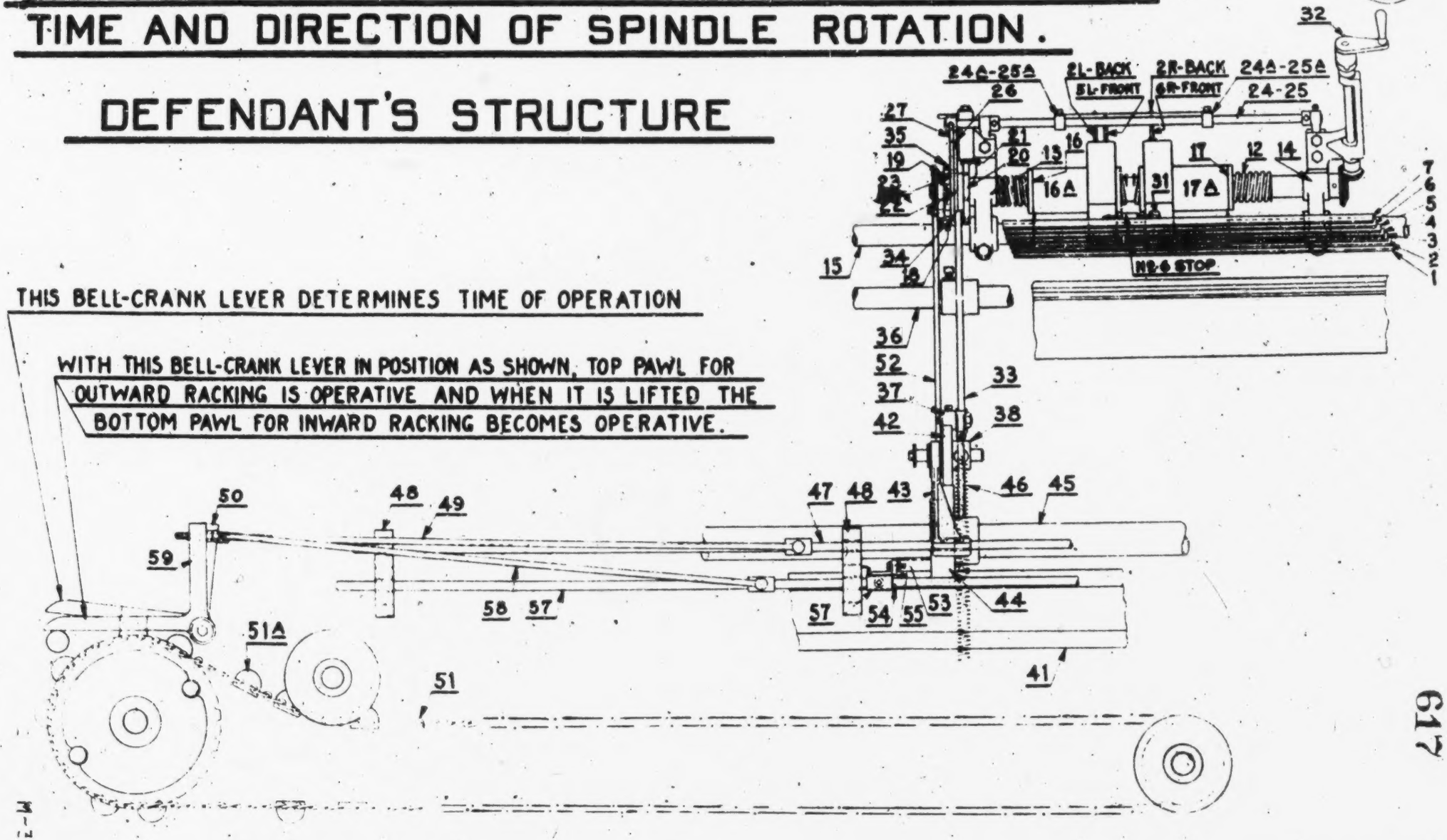
DEFENDANT'S STRUCTURE

BACK STOP PINS UP - CLOCKWISE RACKING WITH TOP PAWL



PATTERN CHAIN CONTROL FOR DETERMINING TIME AND DIRECTION OF SPINDLE ROTATION.

DEFENDANT'S STRUCTURE



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DEFENDANT'S EXHIBIT N

I N D E X

Patentee	Patent No.	Tab No.
Cecka	1,180,568	1
Cecka	1,217,411	2
Chipman	1,163,970	3
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F. CECKA.

KNITTING FRAME.

APPLICATION FILED JAN. 14, 1915.

1,180,568.

Patented Apr. 25, 1916.

2 SHEETS—SHEET 1.

Fig. 2.

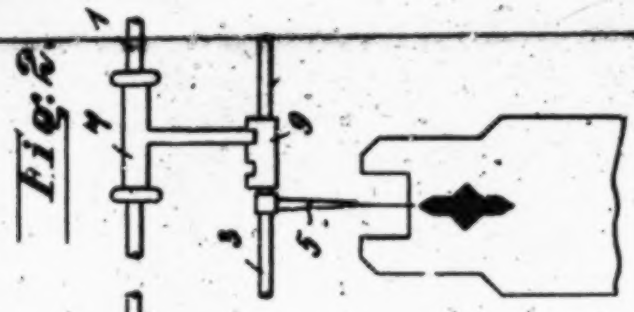
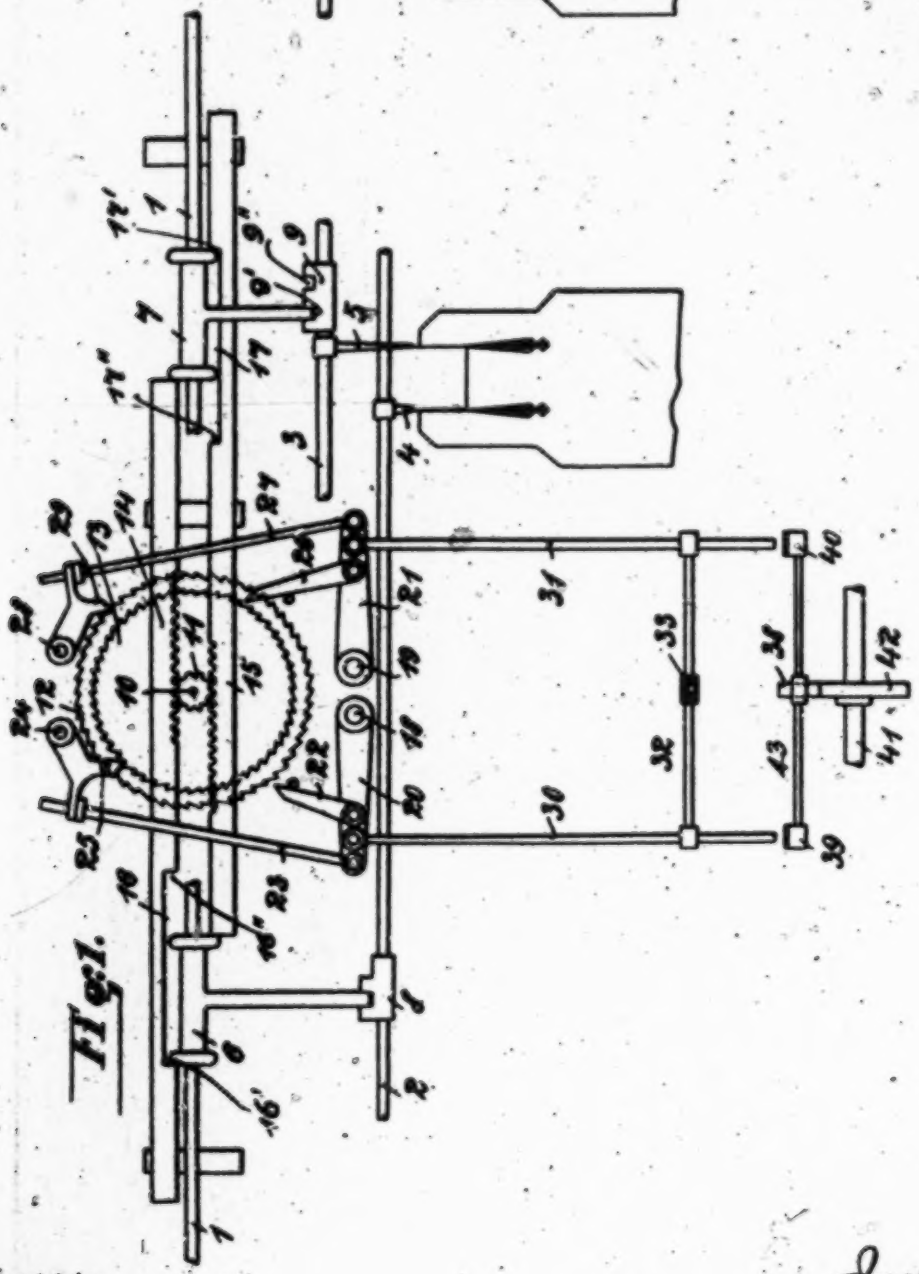


Fig. 1.



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KNITTING FRAME.

APPLICATION FILED JAN. 14, 1915.

1,180,568.

Patented Apr. 25, 1916.

2 SHEETS—SHEET 2.

Fig. 3.

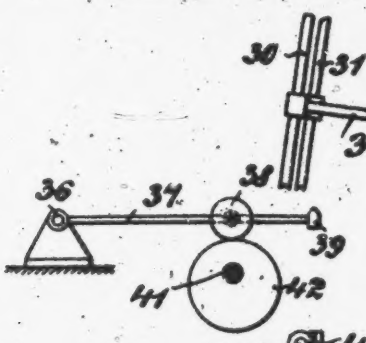


Fig. 4.

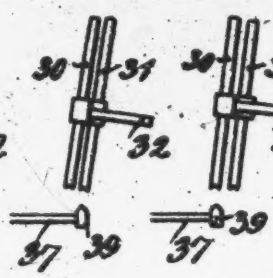


Fig. 5.

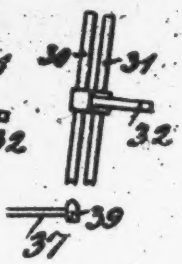


Fig. 6.

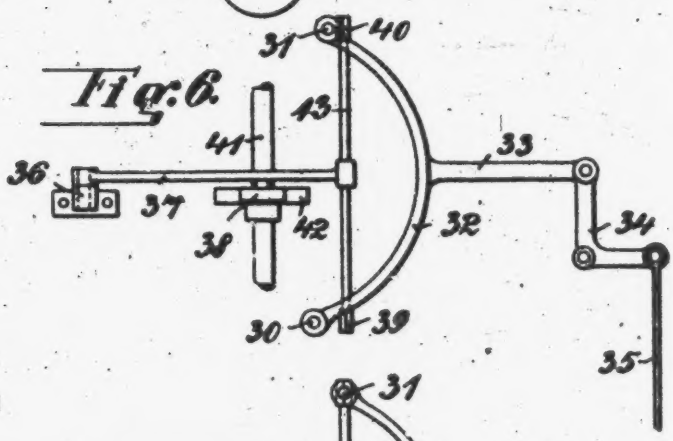


Fig. 7.

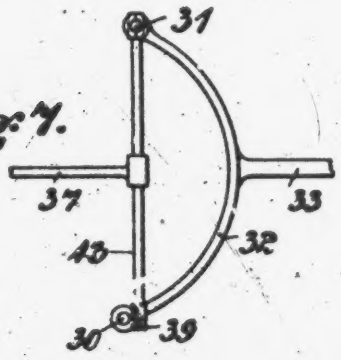
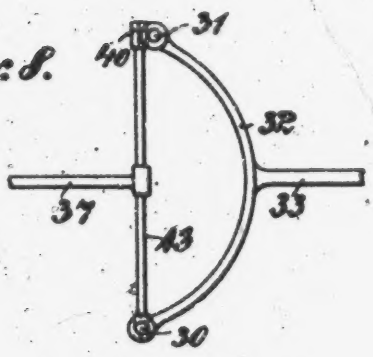


Fig. 8.



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by Henry Orth & Co. Atty

UNITED STATES PATENT OFFICE.

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KNITTING-FRAME.

1,180,568. Specification of Letters Patent. Patented Apr. 25, 1916.

Application filed January 14, 1915. Serial No. 2,174.

To all whom it may concern:

Be it known that I, FRANZ CECKA, a citizen of the German Empire, residing at Chemnitz, in the Kingdom of Saxony, Germany, have invented certain new and useful Improvements in Knitting-Frames; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in knitting frames, and more particularly in apparatus for knitting in hosiery or the like patterns from reinforcing threads, and the object of the improvements is to provide an apparatus of this class, by means of which reinforced portions can be knitted in the medial parts of the fabric as distinguished from known frames by means of which reinforced portions can be knitted only at the sides of the fabric. Thereby I am enabled to produce patterns of various form, and the effect of such reinforced portions can be increased by knitting the same from threads of a color different from that of the foundation.

For the purpose of explaining the invention an example embodying the same has been shown in the accompanying drawings, in which the same letters of reference have been used in all the views to indicate corresponding parts.

In said drawings—Figure 1, is a front view of the parts of the knitting frame to which my invention more particularly relates, Fig. 2, is a detail view showing one of the thread guides in a different position, and Figs. 3 to 8, are respectively side views and plan views of the driving elements of the improved apparatus and showing the same in different positions.

For the purpose of explaining the invention reference will be made to a flat hosiery frame of known construction. But I wish it to be understood, that my invention is not limited to the construction shown in the drawings, nor to the use in combination with a flat hosiery frame.

Referring now to the drawings, a rod 1 is connected in the usual way with a slur connecting bar (not shown) so as to take part in the reciprocating movements of the same. The rod is adapted to impart reciprocating movement to rails 2 and 3 which carry additional thread guides 4 and 5 which are used in knitting reinforcing threads. The rod 1 carries thread guide brakes 6 and 7 the arms of which are arranged for engagement in carrying members 8 and 9 provided on the rails 2 and 3. The carrying member 9 is formed with two notches 9′ and 9″ which are adapted to be engaged by the arm of the brake 7.

To a shaft 10 a pinion 11 is secured which is connected with ratchet wheels 12 and 13 having their teeth disposed in opposite directions, and which is engaged on opposite sides by racks 14 and 15 formed with reduced portions 16 and 17 providing shoulders 16′, 16″ and 17′, 17″. The rod 1 on which the thread guide brakes 6 and 7 are mounted is located between the rails 14 and 15. The brake 6 extends between the shoulders 16′ and 16″ of the rack 14 and the brake 7 between the shoulders 17′ and 17″ of the rack 15. The end of the rack 14 is located in the path of the brake 7 and the end of the rack 15 in the path of the brake 6.

At 18 and 19 levers 20 and 21 have rocking supports. The lever 20 carries a pawl 22 which is adapted to act on the ratchet wheel 12, and it has an arm 23 linked thereto which is connected with a pawl 25 mounted at 24 and acting on the ratchet wheel 13. The lever 21 carries a pawl 26 which acts on the ratchet wheel 13, and it has an arm 27 linked thereto which is connected with a pawl 29 supported at 28 and acting on the ratchet wheel 12. Furthermore to the lever 20 a link 30 is jointed and to the lever 21 a link 31. The links 30 and 31 are connected by a bail 32. The latter is made integral with an arm 33 which is connected by a bell crank lever 34 with a rod 35 connected with a counting mechanism, a Jacquard pattern, or the like.

On a bracket 36 a lever 37 is mounted which carries a rotary disk 38. The free end of the said lever carries a transverse arm 43, the end parts 39 and 40 of which extend into the paths of the links 30 and 31. To a shaft 41 and in position for engagement with the disk 38 a cam 42 is secured.

The operation of the apparatus is as fol-

lows: As appears from Figs. 3 to 8, the bail 32 has such a form, that the links 30 and 31 are staggered with relation to each other. When the cam 42 secured to the shaft 41 is being rocked, it imparts reciprocating movement in vertical direction to the lever 37. With the bail 32 and the links 30 and 31 in the positions shown in Figs. 3 and 6 this movement has no influence on the ratchet mechanism. When the bail is set by the counting mechanism in either one of the positions shown in Figs. 4 and 7, the link 31 gets in position above the end part 40 of the transverse arm 43 connected with the lever 37, so that when the lever 37 is rocked upward the link 31 is lifted, so that the lever 21 is rocked and the pawl 26 advances the ratchet wheel 13. Thereby the racks 14 and 15 which are in engagement with the pinion 11 are shifted respectively to the right and to the left. When the bail 32 and the links 30 and 31 are set in the positions shown in Figs. 5 and 8, the link 31 gets out of the path of the end part 40 of the arm 43 and the link 30 gets in position above the end part 39 and causes the pawl 22 to act on the ratchet wheel 12. Thereby the rods 14 and 15 are moved in the opposite direction.

In Fig. 1 I have shown the parts in the positions in which the brake 6 is engaged by the shoulder 16′ of the reduced portion 16 of the rack 14 and by the end of the rack 15. In the same way the brake 7 is held in position by the shoulder 17′ of the rack 15 and the end of the rack 14. Therefore the thread guides 4 and 5 can not move. If it is desired to knit reinforced patterns, the rod 14 is shifted to the left by the ratchet mechanism, so that the brakes are released and can move so as to be able to move together with the rod 1. According to the path through which the brakes can move also the additional thread guides 4 and 5 can move. The path of the latter can be increased to the length of the reduced portions 16 and 17. By properly operating the ratchet mechanism and thereby increasing or decreasing the path patterns of different form can be produced.

In order that instead of a pattern which is repeated on the fabric a central pattern can be produced the second notch 9″ of the carrier 9 is provided. When the arm of the thread guide brake 7 is thrown into engagement with the notch 9″, the thread guide 5 gets in a medial position, as is shown in Fig. 2, and the thread guide 4 must be thrown out of operation. For limiting the paths of the brakes 6 and 7 special arms or the like may be secured to the rods 14 and 15, which can be made so as to be set in different positions for changing the path of the brake.

Preferably the upper ends of the parts 39 and 40 are in the form of edges and the lower ends of the links 30 and 31 are formed with notches. The latter are engaged by the edges of the parts 39 and 40 and prevent the same from sliding off when lifting the links.

I claim herein as my invention:

1. In a knitting frame, the combination with the main knitting mechanism, of at least one additional thread guide, operating means therefor yieldingly connected therewith, a pair of parallel racks adapted to stop the thread guide, a pinion engaging said racks for movement thereof in opposite directions, a pair of pawls and ratchet wheels connected with the pinion for rotation of the same in opposite directions, shiftable links carrying each one of the pawls, a rocker adapted to shift the links, operating means for the rocker, and operating means for the pawls.

2. In a knitting frame, the combination with the main knitting mechanism, of at least one additional thread guide, operating means therefor yieldingly connected therewith, a pair of parallel racks adapted to stop the thread guide, a pinion engaging said racks for movement thereof in opposite directions, a pair of pawls and ratchet wheels connected with the pinion for rotation of the same in opposite directions, shiftable links carrying each one of the pawls, a rocker adapted to shift the links, operating means for the rocker, means to set the links in positions for operation by the rocker, and operating means for the pawls.

3. In a knitting frame, the combination with the main knitting mechanism, of at least one additional thread guide, operating means therefor yieldingly connected therewith, a pair of parallel racks adapted to stop the thread guide, a pinion engaging said racks for movement thereof in opposite directions, a pair of pawls and ratchet wheels connected with the pinion for rotation of the same in opposite directions, shiftable links carrying each one of the pawls, a rocker adapted to shift the links, operating means for the rocker, automatically controlled means to set the links in positions for operation by the rocker, and operating means for the pawls.

4. In a knitting frame, the combination with the main knitting mechanism, of at least one additional thread guide, operating means therefor yieldingly connected therewith, a pair of parallel racks adapted to stop the thread guide, a pinion engaging said racks for movement thereof in opposite directions, a pair of pawls and ratchet wheels connected with the pinion for rotation of the same in opposite directions, shiftable links carrying each one of the pawls, a rocker adapted to shift the links, operating means for the rocker, means to set either one of the links in positions for operation by the rocker, and operating means for the pawls.

5. In a knitting frame, the combination with the main knitting mechanism, of two additional thread guides, means for imparting a reciprocating motion to said guides, a carrying member for at least one of the said additional thread guides, an adjustable connection between said reciprocating means and said carrier adapted to change the position of said carrier relatively to said reciprocating means, and automatic means for varying the stroke of the additional thread guides at both ends of the stroke.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

FRANZ CECKA. [L. S.]

Witnesses:
F. E. STEGER, [L. S.]
W. H. MÜCKE. [L. S.]

474B

F. CECKA.

HOSIERY FRAME.

APPLICATION FILED OCT. 16, 1915.

1,217,411.

Patented Feb. 27, 1917.

Fig. 1.

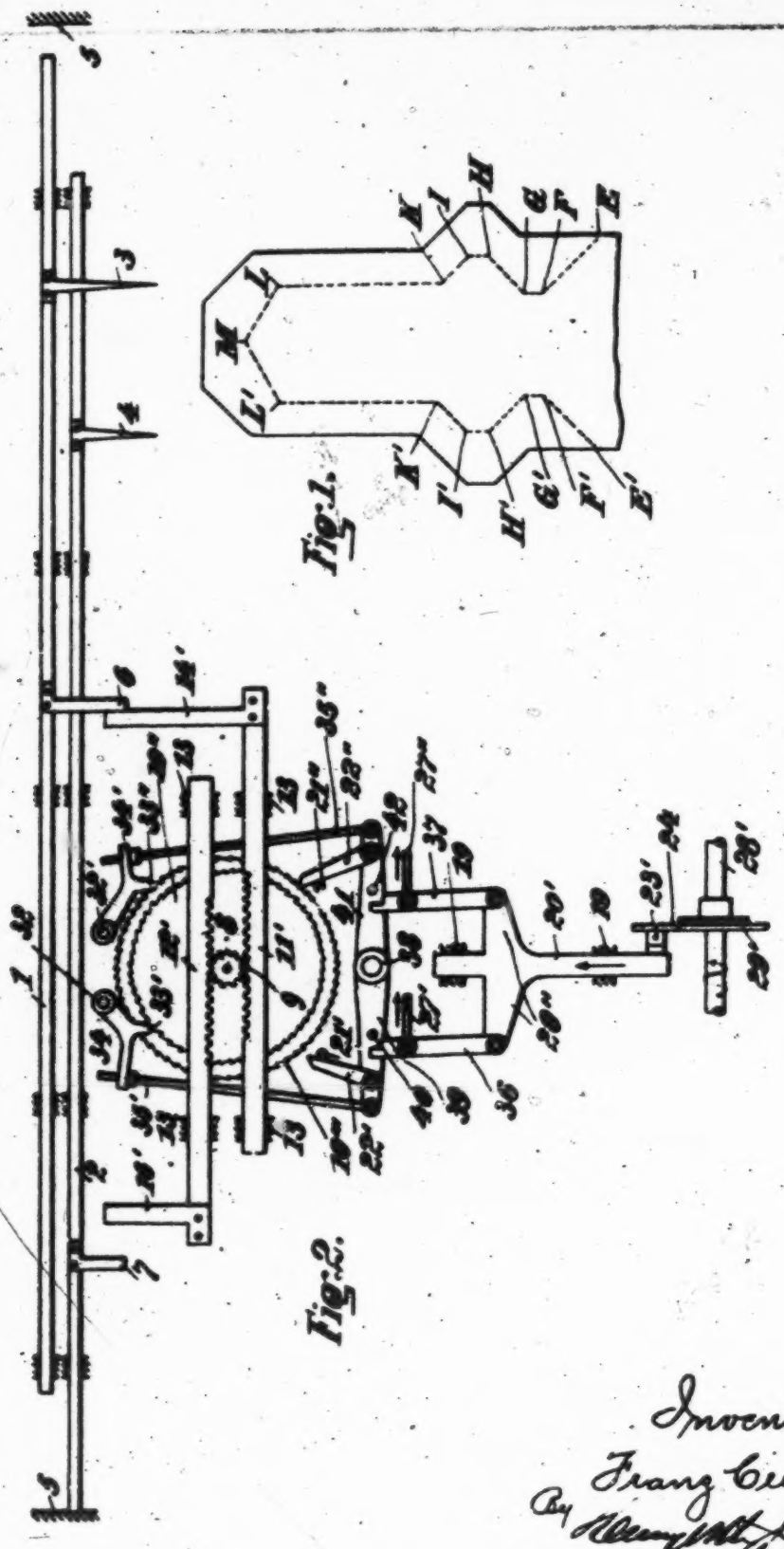

Fig. 2.

Inventor
Franz Cecka.
By Henry Orth & Co
Attys

UNITED STATES PATENT OFFICE.

FRANZ CECKA, OF CHEMNITZ, GERMANY, ASSIGNOR TO THE FIRM OF SCHUBERT & SALZER MASCHINENFABRIK, AKTIENGESELLSCHAFT, OF CHEMNITZ, GERMANY.

HOSIERY-FRAME.

1,217,411. Specification of Letters Patent. Patented Feb. 27, 1917.

Original application filed July 22, 1914, Serial No. 852,417. Divided and this application filed October 16, 1915. Serial No. 56,287.

To all whom it may concern:

Be it known that I, FRANZ CECKA, a citizen of the German Empire, residing at Chemnitz, in the Kingdom of Saxony, Germany, have invented certain new and useful Improvements in Hosiery-Frames; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, this being a division of my application, Serial No. 852,417, filed July 22, 1914.

My invention relates to improvements in hosiery frames, and more particularly in the mechanism for reducing and increasing the inward stroke of the thread guide.

When making reinforced portions in knitted goods on flat hosiery frames the inward stroke of the thread guide is limited by means of fixed stops which correspond to the desired breadth of the reinforced portion. By means of such a mechanism only reinforced portions can be made which have straight border lines, while it is not possible to make fancy reinforced portions.

In my copending application Serial No. 852,417 I have shown and described a mechanism by means of which fancy reinforced portions can be made such mechanism consisting in a pair of stop members each adapted to arrest either one of a pair of thread guides and formed on adjacent sides with rack teeth, a pinion arranged between said stop members engaging in the teeth of the racks so as to shift the stop members in opposite directions upon being operated by a pawl and ratchet mechanism. However, with the mechanism described in the said application only such reinforced portions can be made in knitted goods which are of equal breadth all over. In order to be able to gradually increase the reinforced portions to any desired point and to reduce them thereafter and, if desired, increase them again, the mechanism disclosed in said application has to undergo a certain change which shall hereinafter be explained.

The preferred form of a mechanism according to the present invention is represented in the drawings affixed to this specification,

Figure 1 being a diagrammatical view showing the heel and sole of a stocking made with reinforced portions, and

Fig. 2 a front view showing the modified form of the mechanism by means of which reinforced portions of the form shown in Fig. 1 can be made, in which the breadth of the reinforced portions is increased, from the point E to the point F, and from E′ to F′, whereupon the breadth remains unchanged along the lines F—G and F′—G′, and finally the border lines of the reinforced portions are directed outward and at an angle to the line F—G along the lines G—H and G′—H′ according to the increase in the breadth of the blank. Thereafter the border lines follow parallel lines H—I and H′—I′, whereupon they are again directed angularly and inward along the lines I—K and I′—K′. Thereafter they follow parallel lines K—L and K′—L′, and finally they are directed angularly and toward the middle M of the blank.

In addition to the usual thread guides provided for knitting the non-reinforced parts of the work thread guides 3 and 4 are provided, which coöperate with the said usual thread guides in knitting reinforced portions, as is known in the art. For clearness sake only the thread guides 3 and 4 have been shown, which are secured in the usual way to thread guide bars 1 and 2. The strokes of the bars 1 and 2 are limited at the outer side of the frame by means of stop members 5. To the thread guide bar 1 a stop arm 6 is secured and to the thread guide bar 2 a stop arm 7.

To a shaft 8 a pinion 9 is keyed which is rigidly connected with ratchet wheels 10″ and 10‴ the diameters of which are larger than that of the pinion. The teeth of the wheels 10″ and 10‴ are cut in opposite directions. The pinion 9 is in mesh with racks 11′ and 12′ which are guided in suitable bearings 13. The racks 11′ and 12′ which are in engagement with the pinion 9 are each provided with a single stop 14′ and 16′ respectively mounted at opposite ends of the racks. A push rod 20′ slidably mounted in suitable guides is constructed with transverse arms 20″, 20″ to which push arms 36 and 37 are jointed which are connected with links 27′ and 27″ respectively.

To the lower end of the push member 20' a pivot bolt 23' is secured which provides a support for a sleeve 24' which is non-shiftable thereon and is always in the path of a cam 29' keyed to a shaft 28'.

On a pivot bolt 38 a rocking lever is mounted which consists of two arms 39 and 41. To the arm 39 of the said rocking lever a pin 40 is secured which is [illegible] position for engagement by the push rod 36, and to the arm 41 of the lever a pin 42 is secured which is in position for engagement by the push rod 37. The arm 39 carries a pawl 22' which bears on a pin 21', and the arm 41 carries a pawl 22'' which bears on a pin 21''. Normally the ratchet wheels 10'', 10''' are locked as against rotation in both directions by means of the pawls 33' and 33'', and they are adapted to be released upon operation of the arm 39 or 41 by rods 35' and 35''.

The operation of the mechanism is as follows:

By means of the cam 29' the push member 20' is continuously reciprocated in vertical direction. The push rods 36 and 37 are normally in such positions, that they do not engage the pins 40 and 41. By means of a suitable counting mechanism such as a jacquard pattern, a narrowing chain, or the like, the push rods 36 and 37 can be rocked to the right and in the direction of the arrow shown in Fig. 2. For example, if the push rod 36 is shifted to the right by the link 27', it engages the pin 40 of the arm 39 when the push rod 20' is moving upward. Thereby the pawl 22' is forced toward the ratchet wheel 10''' so as to advance the same. Thereby the rod 11' is shifted to the left and the rod 13' to the right, so that the stops 14' and 16' are approached to each other, the thread guide bar 1 can move farther to the left and the thread guide bar 2 farther to the right, and the thread guides 3 and 4 are moved toward each other. Thereby the reinforced portions E—F and E'—F' can be made the border lines of which are directed at an angle inward.

If on the other hand the push member 37 is shifted to the right by means of the link 27'', it acts on the pin 42 of the arm 41, and the pawl 22' turns the gear wheel 9 in the opposite direction, so that the stops 14' and 16' of the rods 11' and 13' are separated from each other and the inward strokes of the thread guide bars are shortened. Thereby the reinforced portions can be made so as to be directed with their border lines angularly and outward, as is shown in the [illegible]. It will readily be understood that by setting the counting mechanism the stops can be moved in one or the other direction or stopped according to the desired form of the reinforced portion.

I claim herein as my invention:

1. In a hosiery frame, the combination with a pair of thread guides having reciprocating movements in opposite directions, of a pair of parallel rods each having a stop arranged for coöperation with one of the thread guides and formed on adjacent sides with rack teeth, a pinion engaging said rack teeth and adapted to shift the rods in opposite directions, pawl and ratchet mechanisms, adapted to rotate said pinion in opposite directions, operating means moving in one direction, and means to connect said operating means with either one of the pawl and ratchet mechanisms.

2. In a hosiery frame, the combination with a pair of thread guides having reciprocating movements in opposite directions, of a pair of parallel rods each having a stop arranged for coöperation with one of the thread guides and formed on adjacent sides with rack teeth, a pinion engaging said rack teeth and adapted to shift the rods in opposite directions, pawl and ratchet mechanisms adapted to rotate said pinion in opposite directions, operating means moving in one direction, a rocking lever carrying said pawls at opposite sides of its fulcrum, and means to throw said operating means into position for rocking engagement with said rocking lever at either one of its ends.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

FRANZ CECKA.

Witnesses:
W. H. Munchen,
M. Rothe.

476

W. E. CHIPMAN.

KNITTING MACHINE.

APPLICATION FILED NOV. 2, 1910.

1,163,970.

Patented Dec. 14, 1915.

12 SHEETS—SHEET 1.

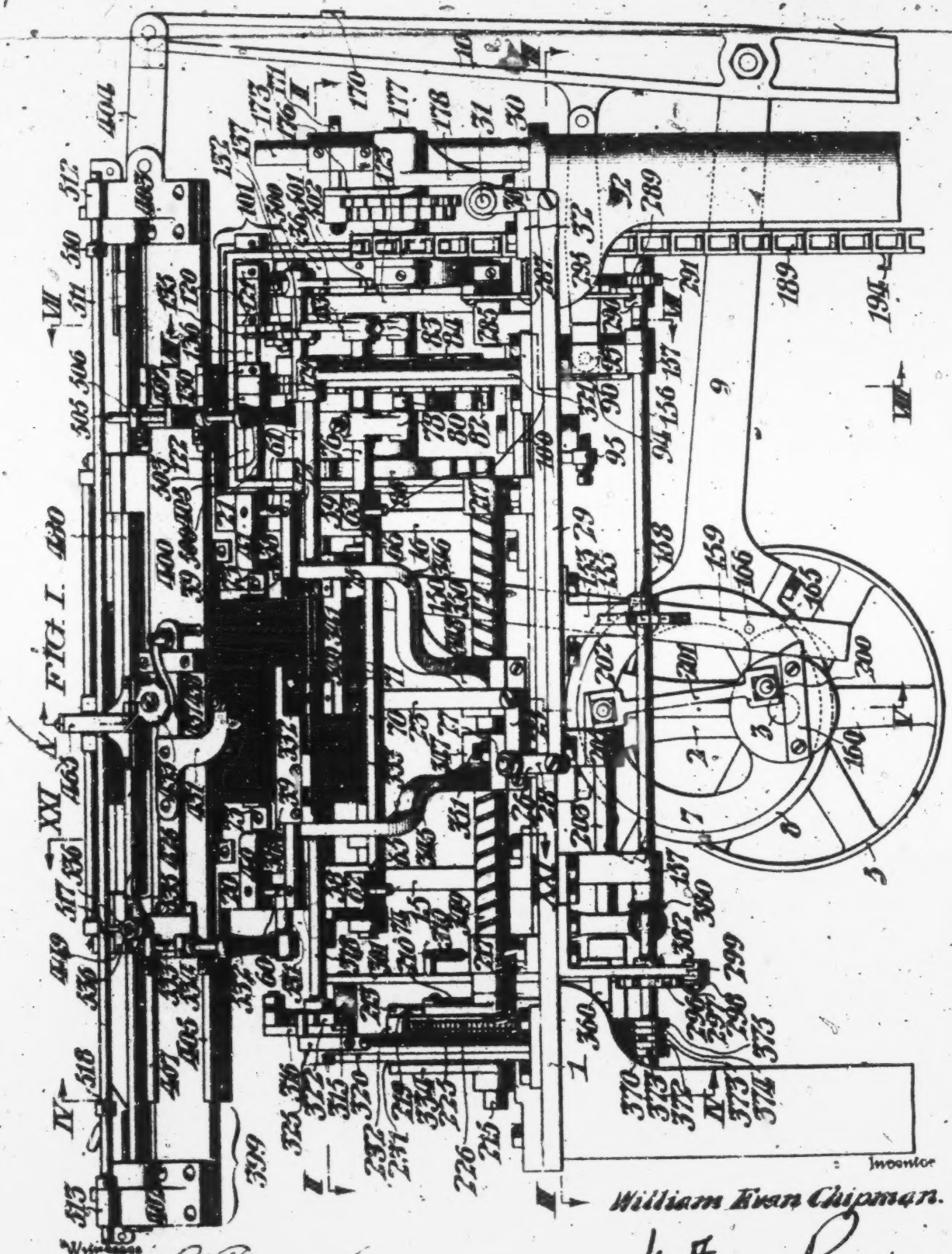

FIG. I.

Witnesses

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James A. Bell

Inventor

William Evan Chipman.

by Fulwey & Paul

Attorneys

477

W. E. CHIPMAN.

KNITTING MACHINE.

APPLICATION FILED NOV. 2, 1910.

1,163,970.

Patented Dec. 14, 1915.

12 SHEETS—SHEET 2.

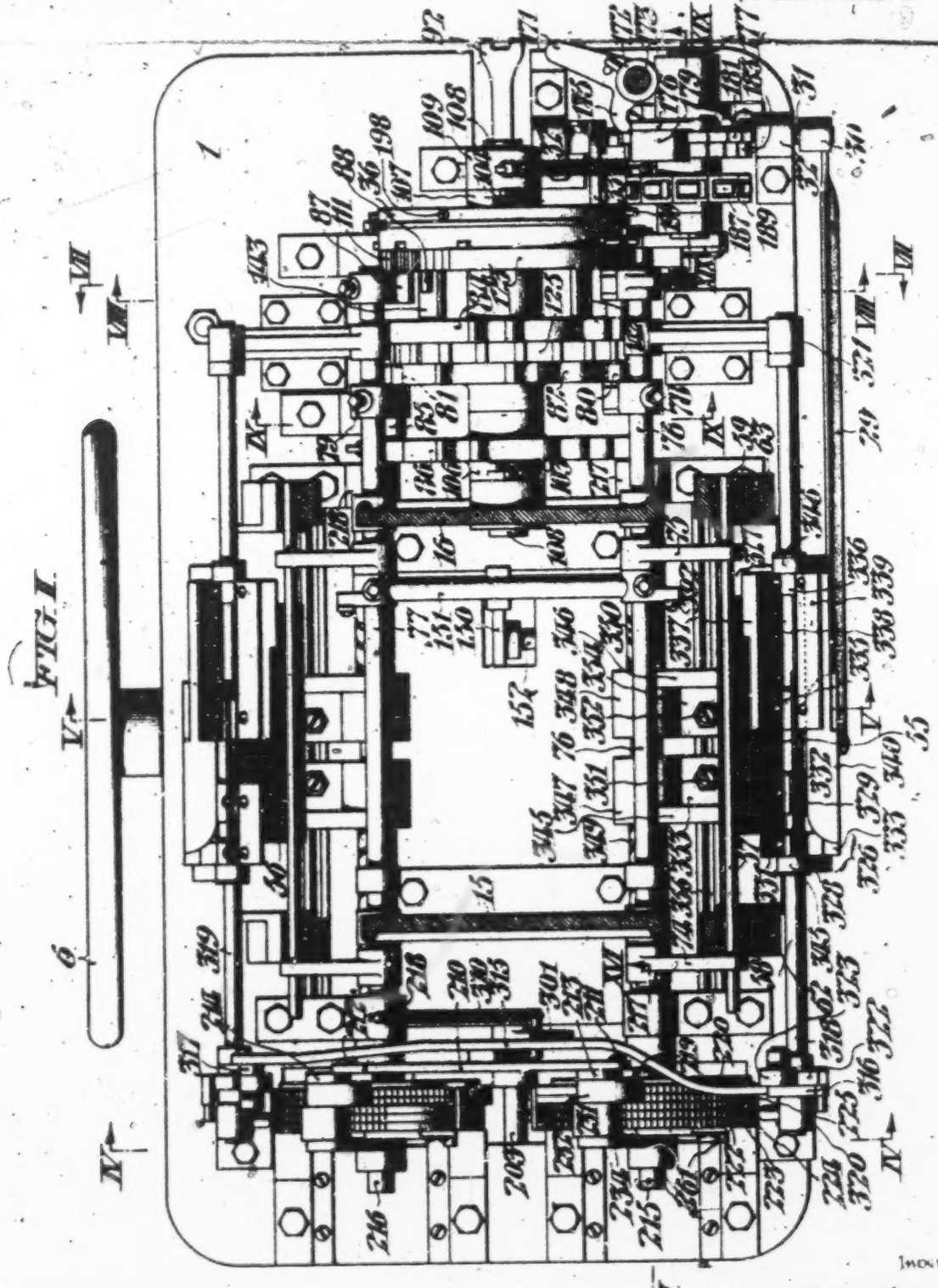

FIG. 4.

Witnesses
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Inventor
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Attys.

478

W. E. CHIPMAN.

KNITTING MACHINE.

APPLICATION FILED NOV. 2, 1910.

1,163,970.

Patented Dec. 14, 1915.

12 SHEETS—SHEET 3.

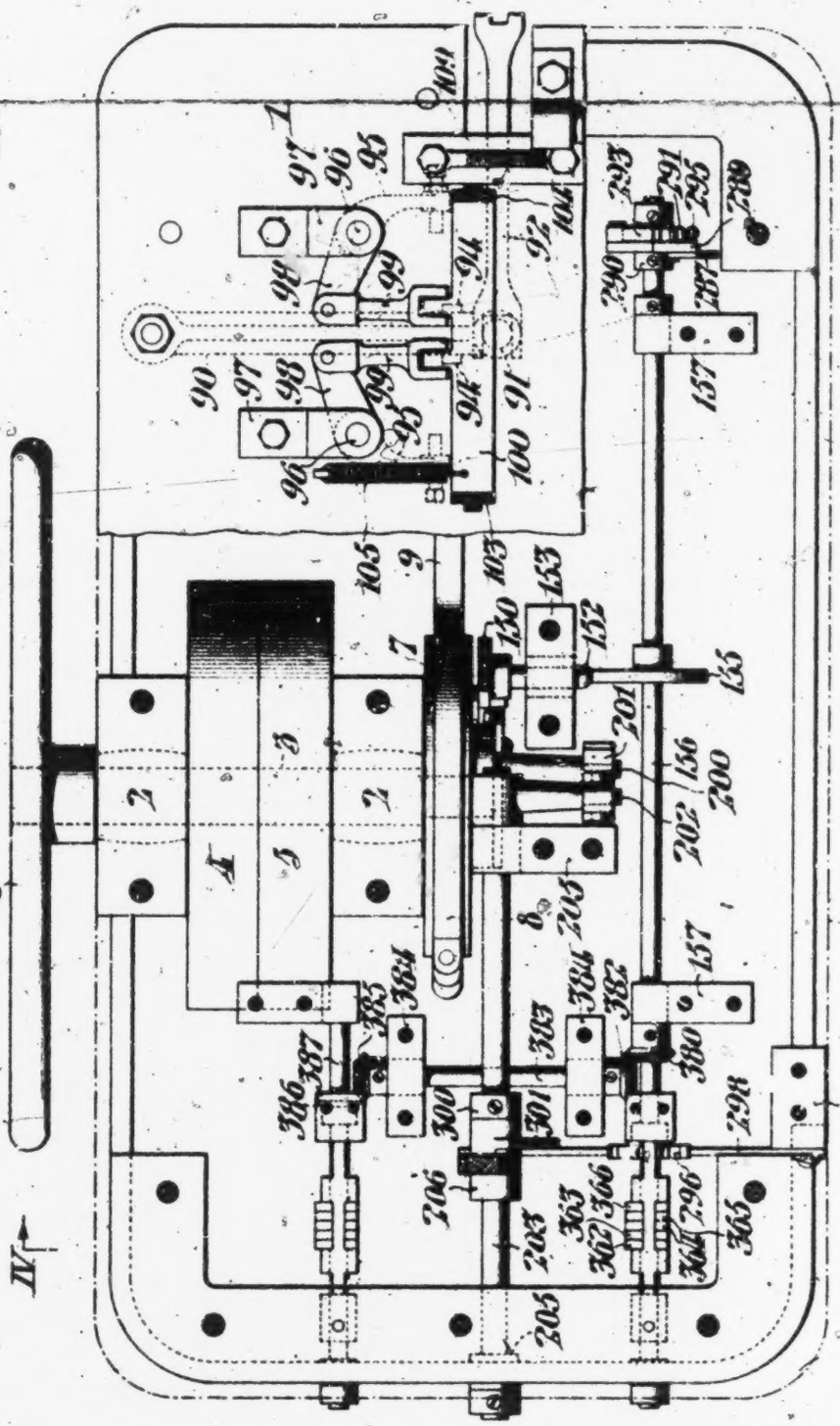

FIG. I.

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by Fulton & Fulton

Witness

John C. Bergner

James H. Bell

479

W. E. CHIPMAN.

KNITTING MACHINE.

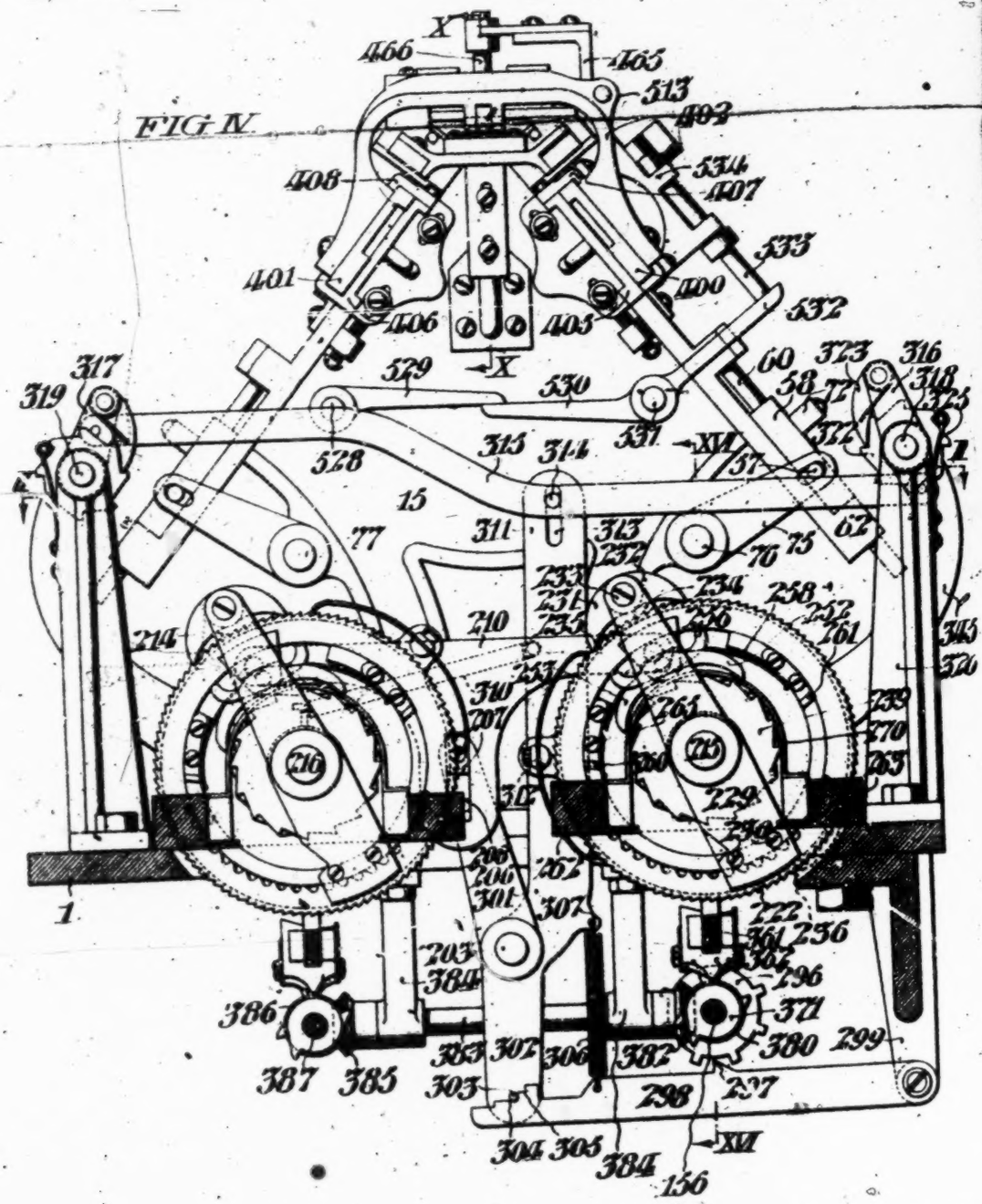
APPLICATION FILED NOV. 2, 1910.

1,163,970.

Patented Dec. 14, 1915.

12 SHEETS—SHEET 4.

FIG IV.



Inventor

William Evans Chipman

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Witnesses

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480

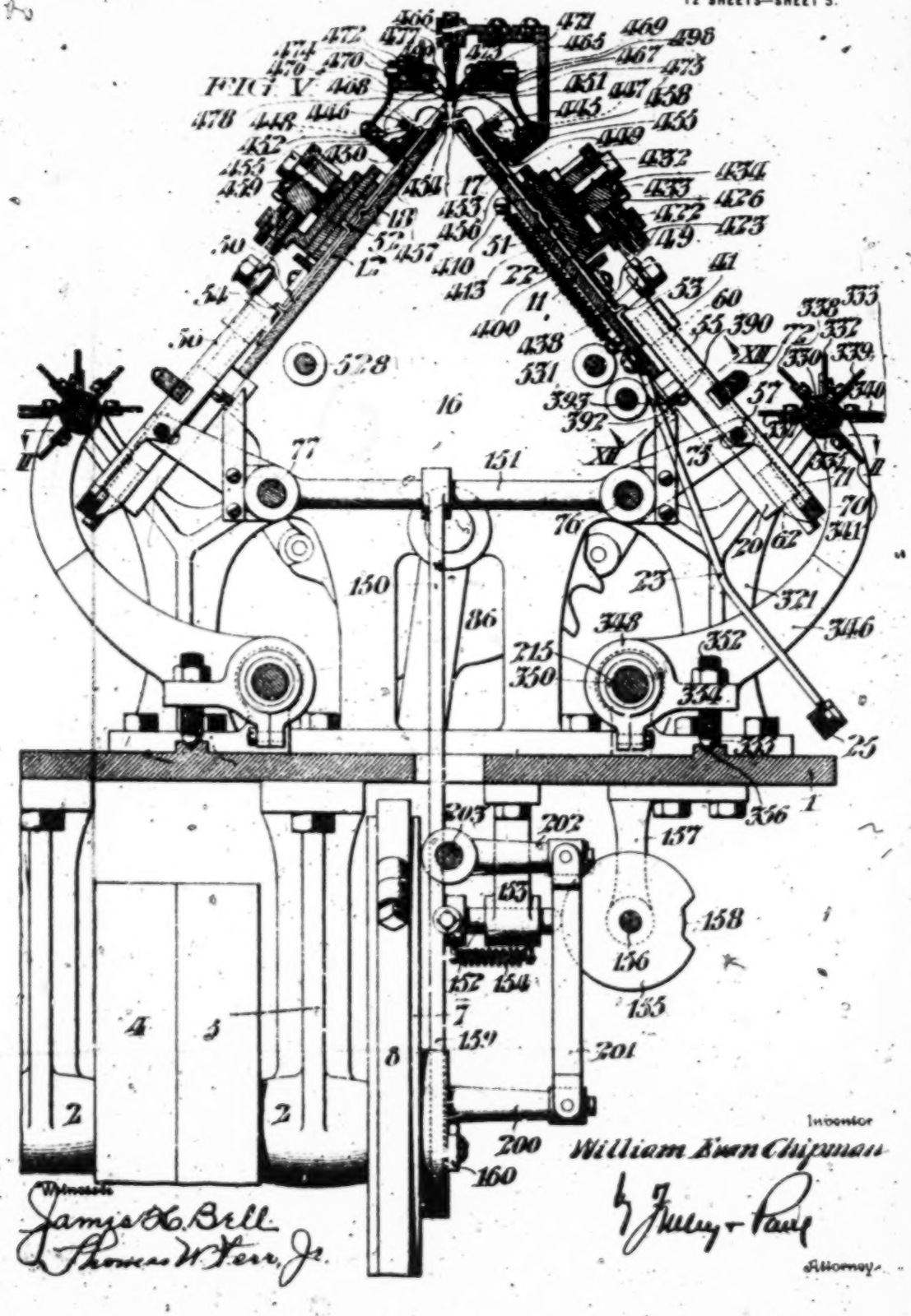
W. E. CHIPMAN.

KNITTING MACHINE.

APPLICATION FILED NOV. 2, 1910.

1,163,970. Patented Dec. 14, 1915.

12 SHEETS—SHEET 5.



481

W. E. CHIPMAN.

KNITTING MACHINE.

APPLICATION FILED NOV. 2, 1910.

1,163,970.

Patented Dec. 14, 1915.

12 SHEETS—SHEET 6.

FIG. VI.

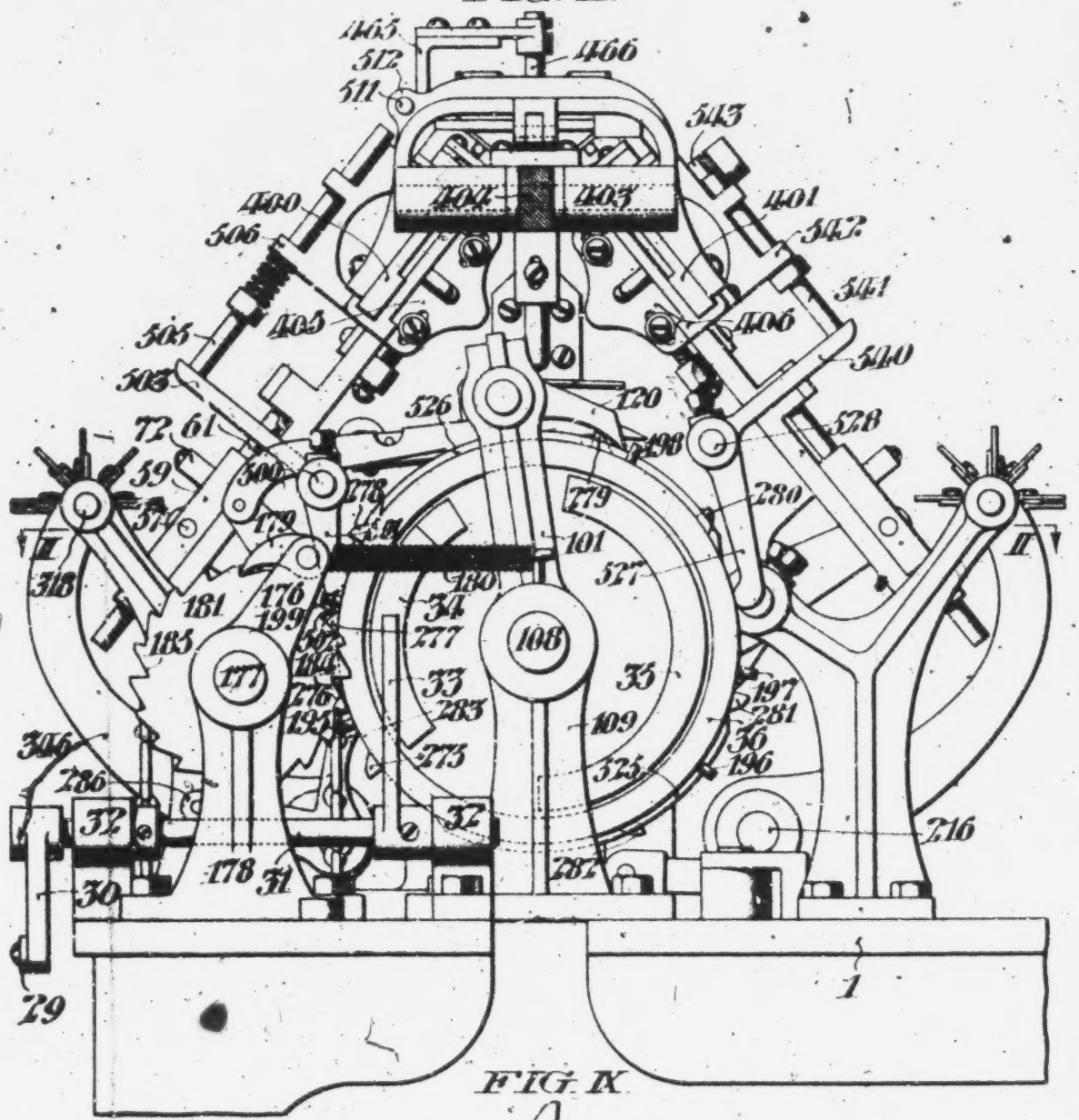
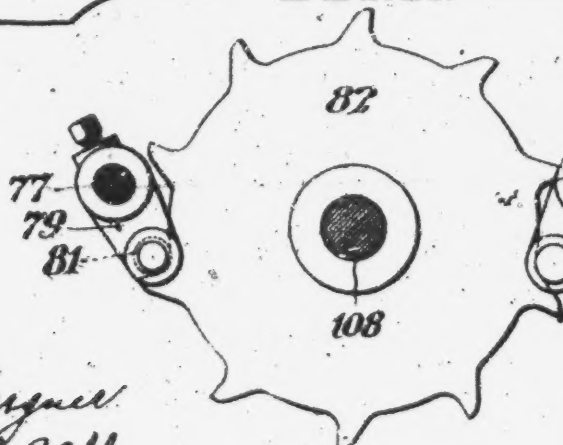


FIG. IX.



Witnesses
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482

W. E. CHIPMAN.

KNITTING MACHINE.

APPLICATION FILED NOV. 2, 1910.

1,163,970.

Patented Dec. 14, 1915.

12 SHEETS—SHEET 7.

FIG. VII

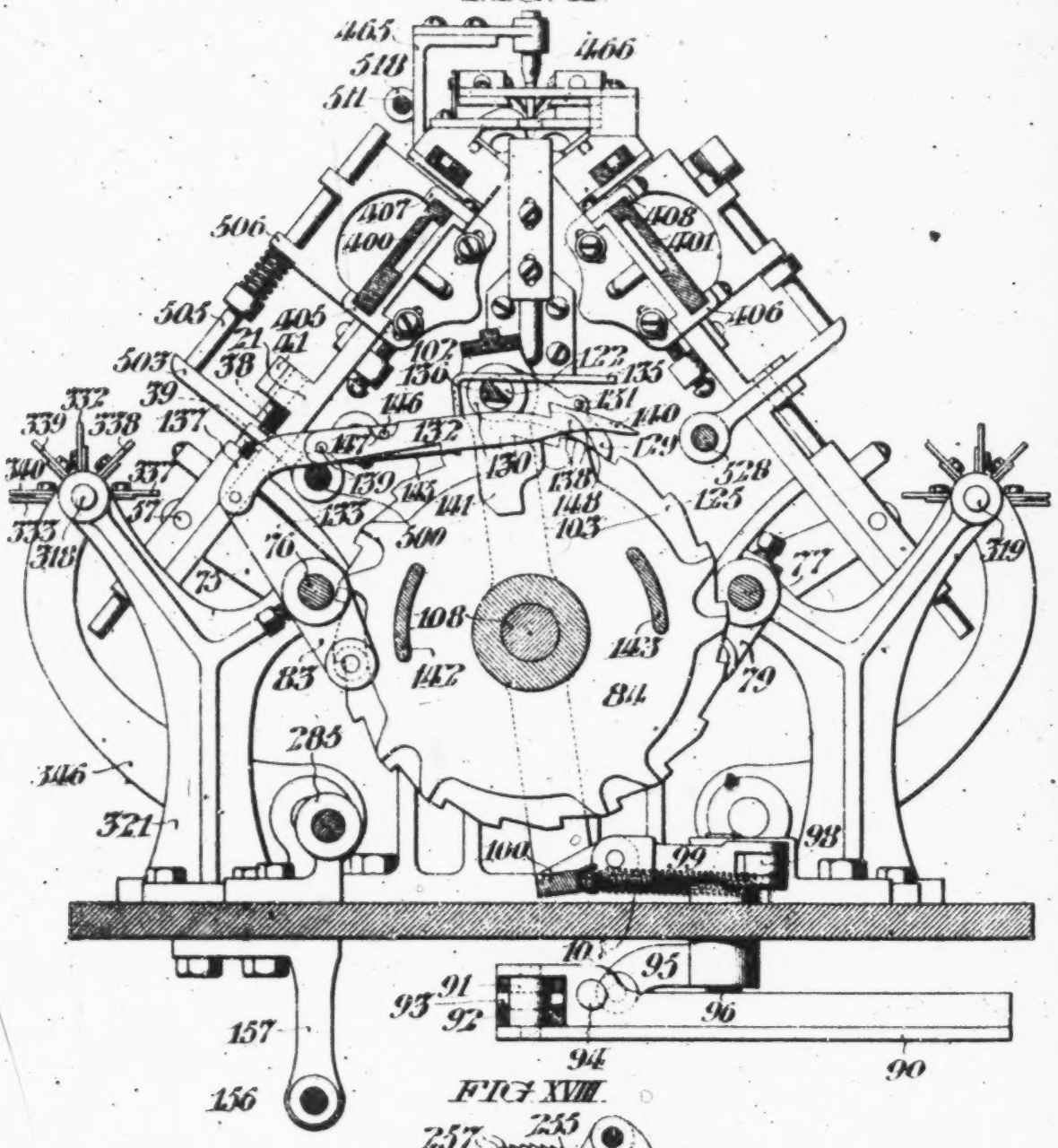
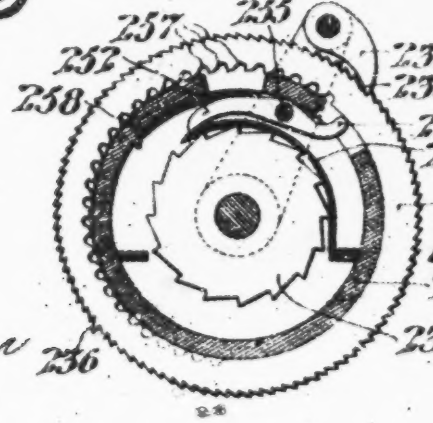


FIG. XVIII



Witnesses
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483

W. E. CHIPMAN.

KNITTING MACHINE.

APPLICATION FILED NOV. 2, 1910.

1,163,970

Patented Dec. 14, 1915.

12 SHEETS—SHEET 8.

FIG. VIII.

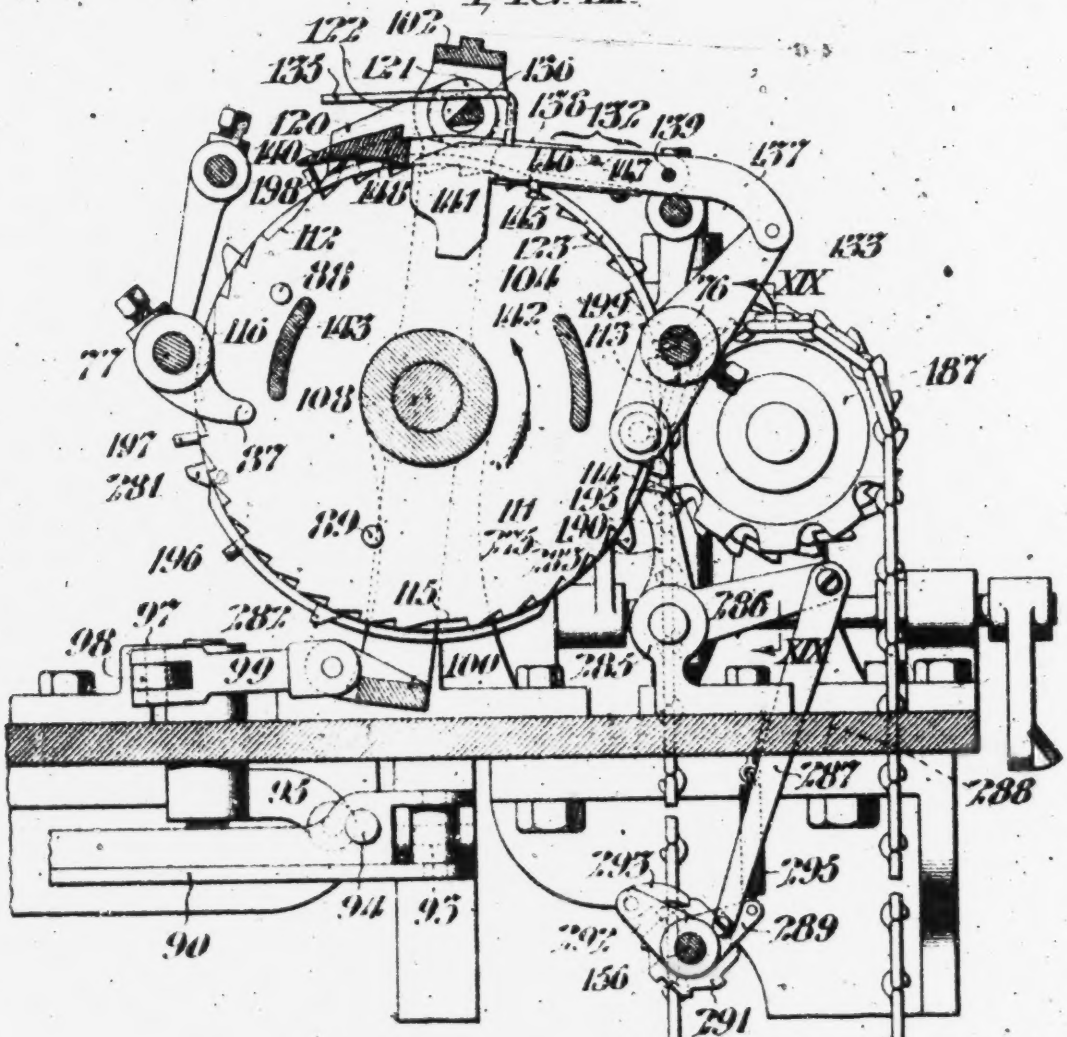


FIG. XIX.

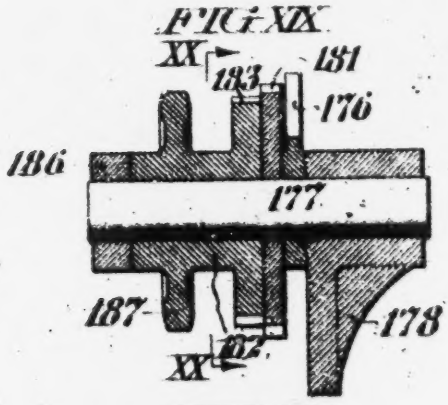
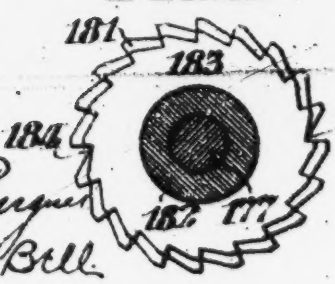


FIG. XX.



Witnesses
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KNITTING MACHINE.

APPLICATION FILED NOV. 2, 1910.

1,168,970.

Patented Dec. 14, 1915.

12 SHEETS—SHEET 9.

FIG. X.

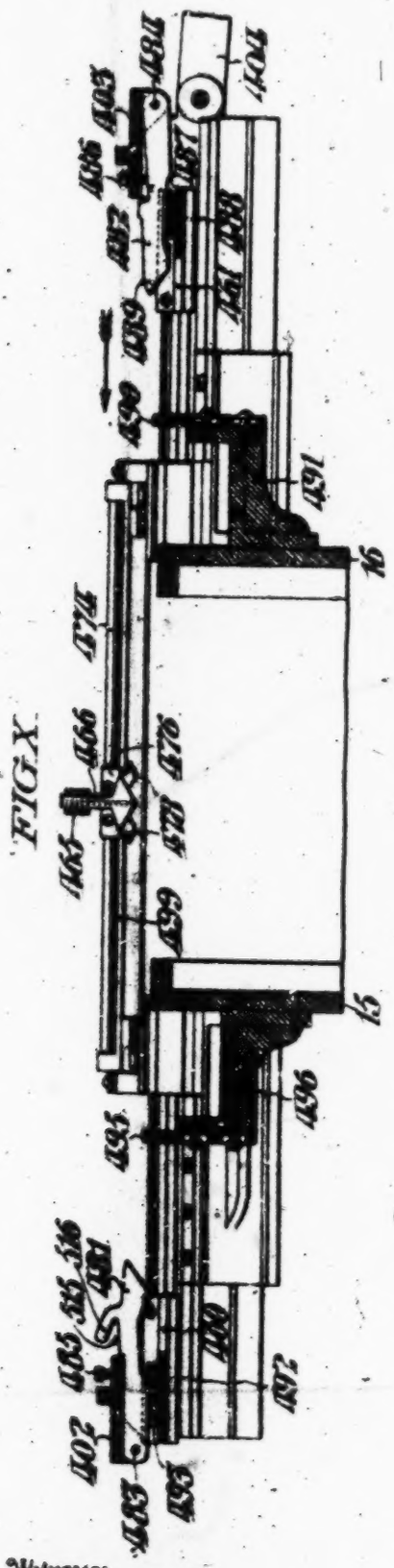

FIG. XI.

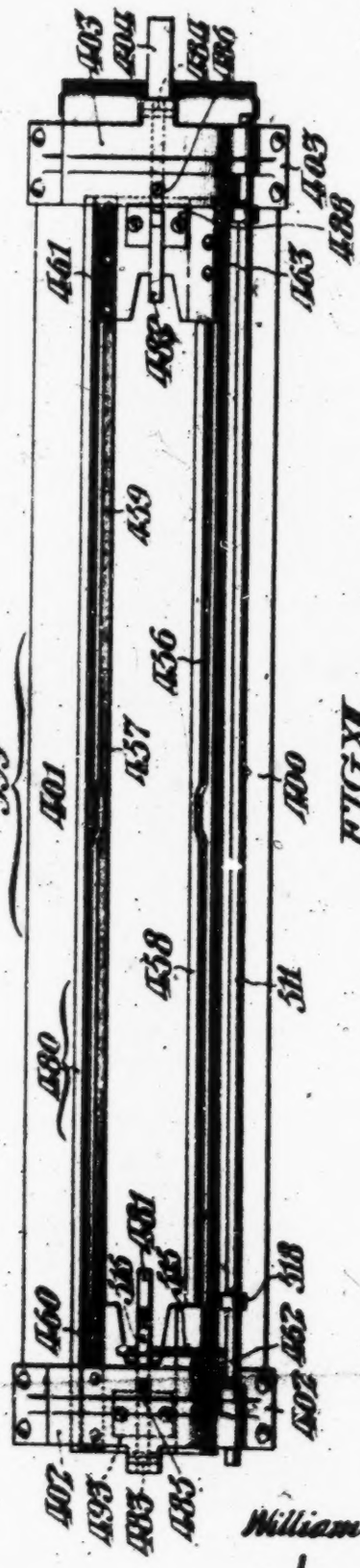

FIG. XI.

Witnesses

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485

W. E. CHIPMAN.

KNITTING MACHINE.

APPLICATION FILED NOV. 2, 1910.

1,163,970.

Patented Dec. 14, 1915.

12 SHEETS—SHEET 10.

FIG. XIII

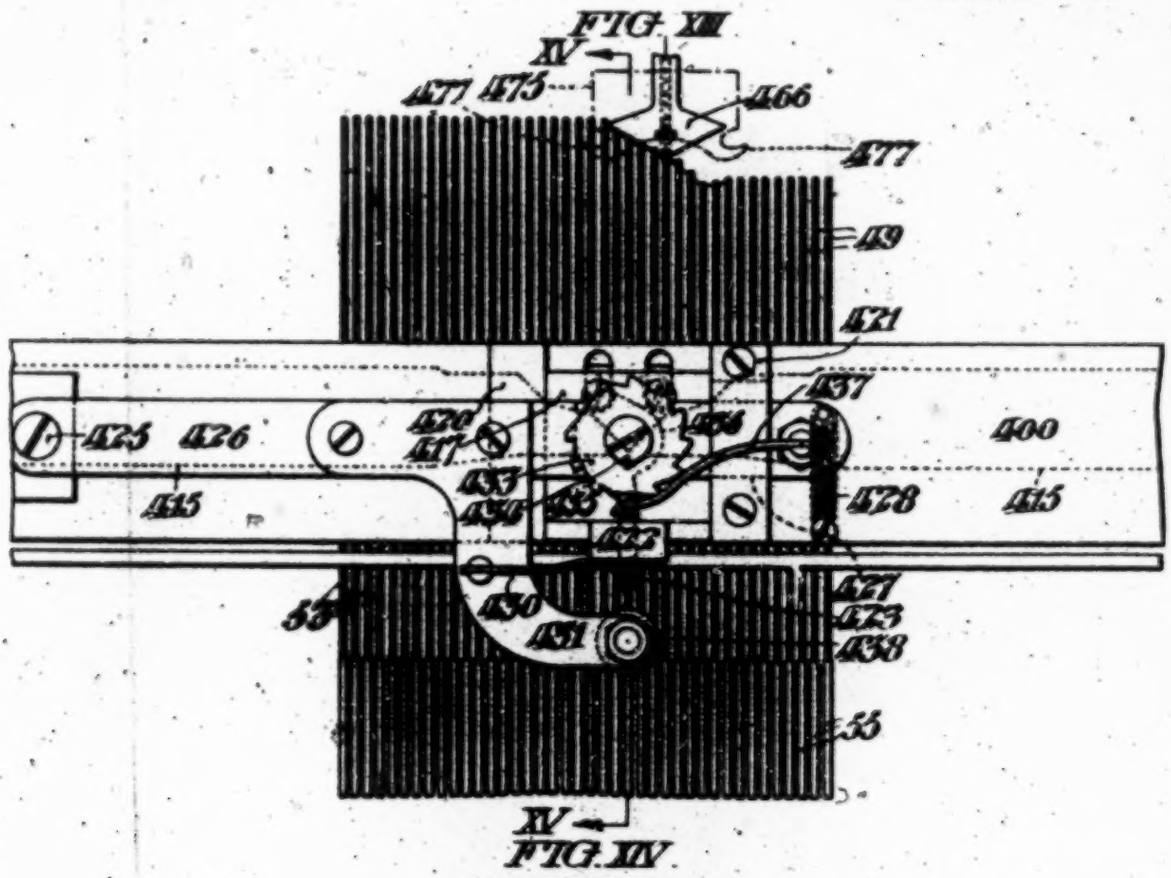


FIG. XIV

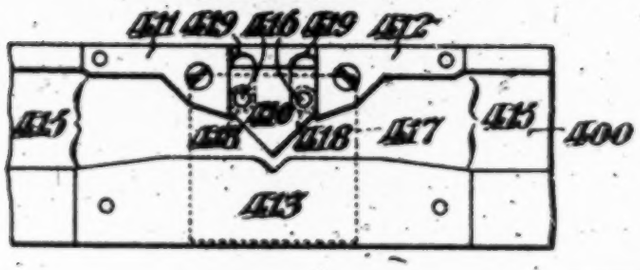


FIG. XV.

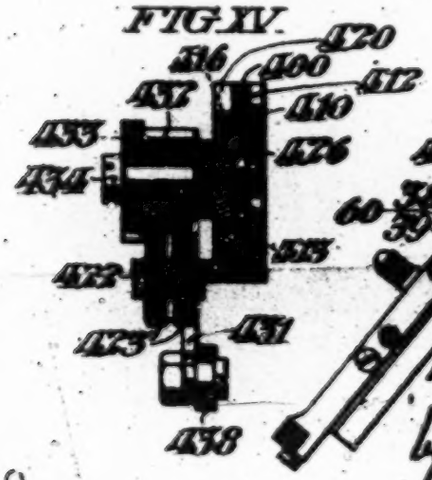
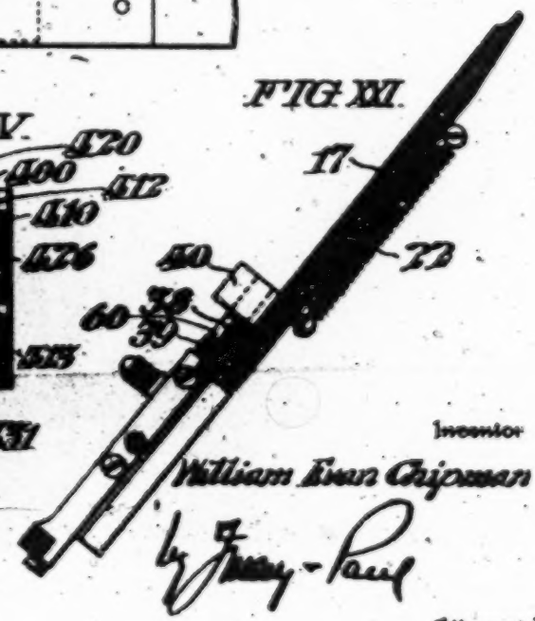


FIG. XI.



Witnesses

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486

W. E. CHIPMAN.

KNITTING MACHINE.

APPLICATION FILED NOV. 2, 1910

1,163,970.

Patented Dec. 14, 1915.

12 SHEETS—SHEET 11.

FIG. XVI.

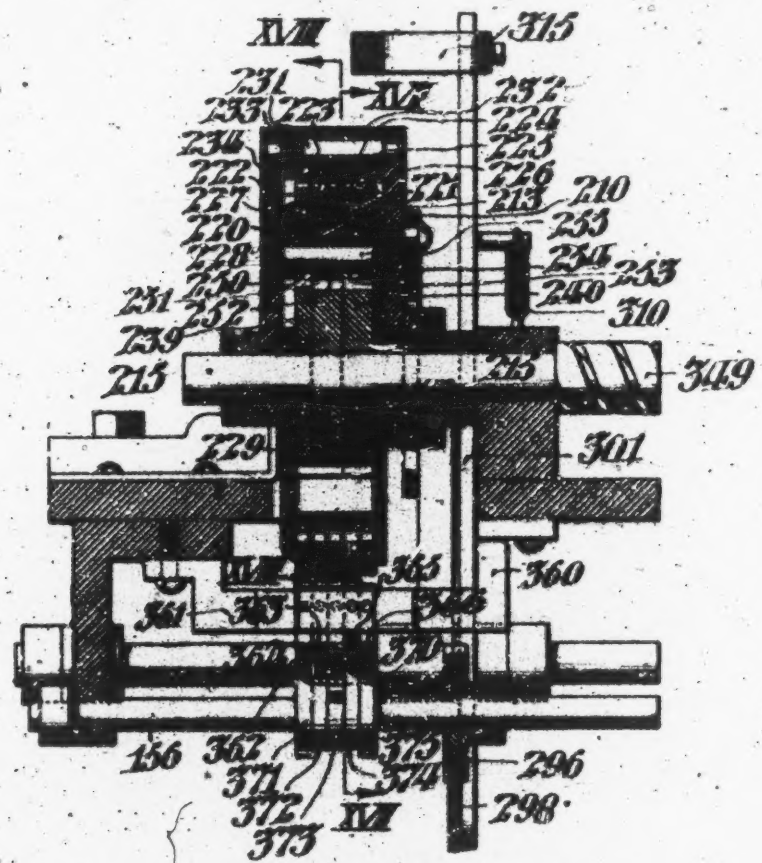
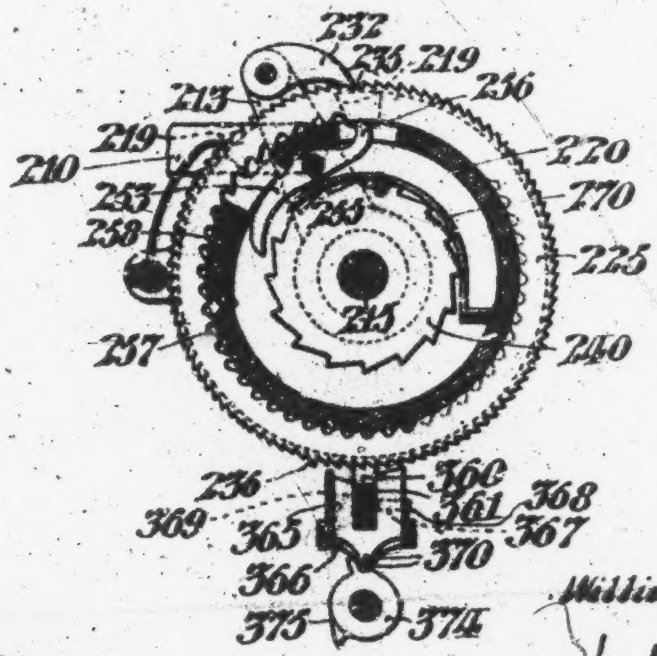


FIG. XVII.



Witnesses

John C. Bergner

James H. Bell.

Inventor

William Evan Chipman,

by Fitzgerald & Paul

Attorneys

487

W. E. CHIPMAN.

KNITTING MACHINE.

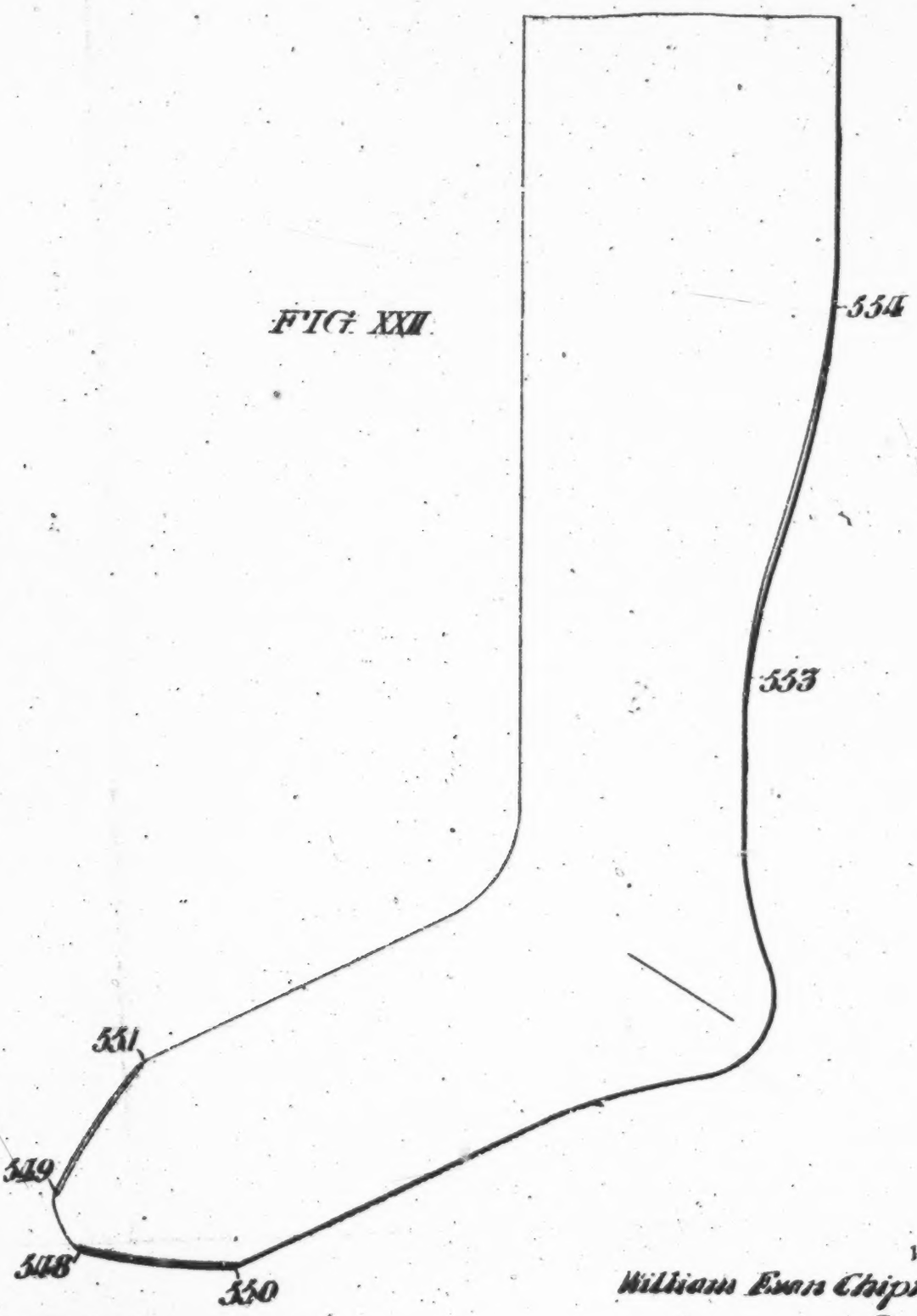
APPLICATION FILED NOV. 2, 1910.

1,163,970.

Patented Dec. 14, 1915.

12 SHEETS—SHEET 12.

FIG. XXII.



Witnesses
James C. Bell.
Thomas W. Lee, Jr.

Inventor
William Evan Chipman,
by Fulley & Peck
Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM EVAN CHIPMAN, OF EASTON, PENNSYLVANIA.

KNITTING-MACHINE.

1,163,970. Specification of Letters Patent. Patented Dec. 14, 1915.

Application filed November 2, 1910. Serial No. 590,143.

To all whom it may concern:

Be it known that I, WILLIAM EVAN CHIPMAN, of Easton, in the county of Northampton and State of Pennsylvania, have invented certain new and useful Improvements in Knitting-Machines, whereof the following is a specification, reference being had to the accompanying drawings.

The invention relates to new and useful improvements in knitting machines, and more especially to straight knitting machines wherein two straight rows of inclined needles are used in knitting a tube which may be fashioned to form a stocking.

Where tubular fabrics are knit on a machine of the above character, and the tube is widened by bringing into action one or more needles, holes are formed in the fabric at the widened portion, which makes an objectionable stocking. In order to overcome this objection, and to strengthen the stocking at the widened portion, an object of the present invention is to provide mechanism for knitting a strengthening gore which may be joined with the stitches that are united to form the widened portions of the stocking.

A further object of the invention is to provide a knitting machine of the above character with cam wheels for raising and lowering the needles, which cam wheels are controlled by a change cam which in turn is controlled by a pattern chain.

A further object of the invention is to provide a machine of the above character with individual jacks for raising the needles, and stitch cams for depressing the needles to form the stitches.

A further object of the invention is to provide fashioning plates for controlling the jacks, which raise and lower the needles, which fashioning plates operate during the formation of the toe and the heel and the widened portion of the leg of the stocking.

These and other objects will in part be obvious, and will in part be hereinafter more fully described.

In the accompanying drawings Figure I, is a side elevation of a fashioning knitting machine conveniently illustrating my improvements. Fig. II, is a sectional view on line II, II, in Fig. I. Fig. III, is a similar view on a lower plane, as indicated at III, III, in Fig. I. Fig. IV, is a vertical cross sectional view taken on the line IV, IV, of Figs. I and II. Fig. V, is a staggered central cross section indicated at V, V, in Figs. I and II. Fig. VI, shows an end elevation of the machine, looking from the right in Figs. I and II. Fig. VII, is a vertical cross section, indicated by line VII, VII, in Figs. I and II. Fig. VIII, is a similar view, looking in the opposite direction, as shown at VIII, VIII, in Figs. I and II. Fig. IX, is a detail cross section on line IX, IX, in Fig. II. Fig. X, illustrates a fragmentary longitudinal section through the upper portion of the machine, as shown by the arrows X, X, in Fig. IV. Fig. XI, is a plan view, showing the relative positions of the needle cam bars and the sinker cam bars. Fig. XII, is a detail sectional view on line XII, XII, in Fig. V. Fig. XIII, shows in detail one of the actuating mechanisms for the stitch cams. Fig. XIV, is a fragmentary elevation of the inner face of one of the needle cam bars at the stitch-forming point. Fig. XV, is a cross section through the needle cam bar, as indicated at XV, XV, in Fig. XIII. Fig. XVI, shows a detail cross section of one of the mechanisms which control the variation of the number of needles during fashioning; this view is indicated at XVI, XVI, in Figs. II and IV. Figs. XVII and XVIII, are vertical sectional views taken on lines XVII, XVII, and XVIII, XVIII, in Fig. XVI, respectively. Fig. XIX, is a detail sectional view on the line XIX, XIX, of Fig. VIII. Fig. XX, is a cross section on line XX, XX, of Fig. XIX. Fig. XXI, is a detail sectional view taken on the line XXI, XXI, in Fig. I, showing one of the screws for limiting the movement of the needle bed, and the spring tending to raise the said bed. Fig. XXII, is a diagrammatic view, showing the stocking knit according to my invention.

In carrying out my invention, I have provided a framework on which is mounted two needle beds, each of which is provided with a straight row of needles. The needles are raised by individual jacks, and are lowered by stitch cams which reciprocate back and forth across the needle beds. The individual jacks are in turn controlled by pattern mechanism so they may be raised to render the jacks ineffective. Each of the sets of jacks is raised and lowered by rock shafts, which are controlled by cam wheels, and these cam wheels are in turn controlled by a change

drum that is rendered effective or ineffective by a pattern chain. This mechanism is preferably intended for knitting a stocking beginning at the toe of the stocking and finishing at the top thereof. In the knitting of the stocking, the needles on both the needle beds are raised and the thread laid into the hooks of the needles, after which the needles on one bed remain idle while a plurality of courses are knitted on the other bed. Then sufficient needles for the beginning of the toe are thrown into action on both beds, and the toe of the stocking knitted and widened and the widening stitches joined with the subsequently knitted courses, which form a strengthening gore for the widened portion of the toe. After the knitting of the toe of the stocking, the foot portion thereof is knit in the usual way. The manner of knitting the heel of the stocking will be described in detail later on. A strengthening gore is knit for the widening portion in the leg of the stocking, in a manner similar to that of the widened portion of the toe.

Taking up the description more in detail, the machine will be described under different headings, for the sake of clearness.

I. The driving mechanism.—In the figures 1, represents the bed plate of the machine, mounted upon suitable legs or standards, and to which are bolted the depending bearing brackets 2, 2, wherein is journaled the main or driving shaft 3. The said shaft 3, carries the usual tight and loose pulley 4, and 5, respectively, and on its other end a hand wheel 6. Secured to the inner end of said shaft is an eccentric 7, having a strap 8, whose rod 9, is pivoted at its outer end to a vertical rocker arm 10, which imparts reciprocatory motion to the thread carrier and to various other parts of the machine. The said rocker arm 10, is fulcrumed at its lower end to the framework of the machine at a point not illustrated in the drawings.

II. The needle beds.—According to my invention, the needles are equally divided and located on opposite sides of the machine, as at 11, and 12, in suitable needle beds. In the motion of the machine in one direction, the needles knit on one side of the machine, and in the return stroke, the needles upon the opposite side become active. In this manner a complete course is knit, upon a tube, and each reciprocation or movement back and forth of the machine corresponds exactly to a rotation of a circular machine. In other words, each set of needles knits a flat web, and each of the flat webs is fashioned and united at the region of the end needles of the two series.

As the needle beds are identical in many respects, it will be only necessary to describe one of them, designating only such of the common parts on the other side as are deemed absolutely necessary to the clear understanding of the operation. For convenience, the side to the right of Figs. IV and V, or that illustrated in Fig. I will be described in detail.

Bolted to the top of the bed plate 1, are standards 15, and 16, which are inclined toward their tops and support the needle bed plates 17 and 18 as best shown in Fig. V. The bed plate 18 is rigidly secured to the standards 15, and 16, but the bed plate 17, is capable of a slight longitudinal motion, so that the needles may be raised and their knitting position brought closer to the other needles. The said plate 17, is mounted between guides 20, and 21, which are respectively secured to the standards 15, and 16, as best shown in Fig. I. Plate 17, is subject to the pull of tension springs 22, which tend to keep it in its upper position. Secured to the back of the said plate 17, is a link 23, whose other end is pivotally connected to one arm 25, of a bell crank lever 26, which is fulcrumed upon a stud 27, on the top of the bed plate 1. The other arm 28, of the bell crank lever 26, is connected by means of a link 29, to the outer end of an arm 30, mounted upon a counter shaft 31, at the right hand end of the machine, as seen in Fig. I. Shaft 31, is journaled in brackets 32, bolted to the top of the bed plate, and carries near its inner end a cam finger 33, which is adapted to be engaged by cams 34, and 35, on the side of a rotatable drum 36, see Fig. VI. The springs 22, already mentioned, which exert their influence upon the needle bed plate 17, also serve to maintain the cam finger 33, in engagement with its cams 34 and 35. When the drum 36, is rotated and the finger 33, allowed to drop into the gaps between its cams 34, and 35, the needle bed is then pulled up by its springs 22, as will be readily understood. The amount of motion of the needle bed 17, is, however, limited by means of adjustable set screws 38, which are mounted in lugs 39, projecting laterally from the bottom edge of the said bed, and which engage extensions 40, and 41, secured to the guides 20, and 21, respectively, (see Figs. I and XA1).

III. Mechanism for the independent control of needles.—Bed plates 17, and 18, as best shown in Fig. V, are provided with the usual grooves for the guidance of their respective needles 49, and 50, having upper butts 51, and 52, which are adapted to be engaged by the knitting cams, and lower butts 53, and 54, which are adapted to be engaged by individual jacks or fingers and thereby raised to the knitting level. Each of the series of needles 49, and 50, is controlled by a series of jacks 55, and 56, respectively, which correspond in number to the needles, and are likewise equally divided on each side of the machine. Jacks 55, corresponding to needles 49, are fulcrumed

upon a rod 57, which is mounted in slide blocks 58, and 59, moving upon suitable guides 60, and 61, which are respectively secured in lugs 62, and 63, projecting from the guides 20, and 21, previously mentioned. See Figs. I and V. Slide blocks 58, and 59, are provided with lateral extensions 65, and 66, to the free ends of which is secured a cross bar 70, provided with slots to maintain the lower ends 71, of the jacks 55, in proper alinement. Each alternate jack is steadied in its motion by means of the slots in bar 70. The remaining alternate jacks are guided by a second slotted cross bar 72, which bridges the top of slide blocks 58, and 59. The jacks 55, are further guided at their upper ends between a pair of angle plates 73, which are secured to needle bed 17, and prevent any lateral motion of the jacks, as best seen in Fig. I. The upper or heavy ends of the jacks 55, and 56, normally rest upon the needle bed in readiness to engage the lower butts of the needles.

In the process of knitting according to my invention, the whole series of jacks on one side of the machine are moved bodily upward by means of a pair of arms 74, and 75, which are slotted at their outer ends to engage the fulcrum rod 57, and are secured to a rock shaft 76, which is journaled in the standards 15, and 16. A similar rock shaft 77, lifts the series of jacks on the other side of the machine. Secured to the shaft 76, slightly to the right of the standard 16, is an arm 78, carrying a roller 80, on its free end, which roller normally engages a cam wheel 82, (see Figs. II and IX). The shaft 77, on the other side of the machine carries an arm 79, having a roller 81, which likewise engages the cam wheel 82. The cam projections on said cam wheel operate first on one rock shaft 76, and then on the other rock shaft 77, and consequently lift the needle jacks first on one side and then on the other.

During the formation of the heel of the stocking, the rock shafts 76, and 77, are shifted to the left, as viewed in Fig. II, thereby moving the rollers 80, and 81, out of the path of the cam wheel 82. The rock shaft 76, carries a second arm 83, that is provided with a roller which by the shifting of the shaft is brought into engagement with a second cam wheel 84, which has double cam projections, as shown in Fig. VII. The arm 79, on the rock shaft 77, has a second roller 85, that during the shift is brought into engagement with the cam wheel 86, having double cam projections similar to the cam projections on the cam wheel 84. These double cam wheels 84, and 86, will lift the needle jacks twice on one side of the machine and then twice on the other side thereof. The shaft 77, is also provided at its right hand end with a finger 87, which lies in the path of a pair of pins 88, and 89, on the left side of a ratchet wheel on the same shaft as drum 36. See Fig. VIII. When these pins engage the finger 87, the shaft 77, is rocked, and the needles on the front of the machine raised. This occurs during the starting of the toe of the stocking. The pins only lift the needles slightly above the hooks of the needles at the rear of the machine, which are at this time raised, and, therefore, a thread can be laid into the hooks of all the needles both at the front and rear of the machine. The needles which are to be lifted during the raising of the jacks, may be controlled by moving the jacks from operative engagement with the needles. By means of the individual jacks for the needles, their knitting may be controlled in the following manner: When the lower ends of the jacks 56, are pressed inwardly by a mechanism which will be explained later, their upper heavy ends will be raised from the path of the lower butts 54, of the needles 50. The jacks thus acted upon will be ineffective upon their corresponding needles in raising them to the stitch level. In this manner, certain needles may be thrown into or out of action, the stocking fashioned and the heel knit.

IV. The controlling drum and its adjunctive parts.—Fulcrumed to the under side of the bed plate is a lever 90, best shown in Figs. III, and VII, whose free bifurcated end carries a rotatable stud 91, which is embraced by the bifurcated end of a link 92, and is movably secured thereto by means of a pin 93, thereby forming a sort of a universal joint, (see Figs. I, III and VIII). The other end of the link 92, is pivoted to the rocker arm 10, at a point somewhat above that at which the eccentric rod 9, is secured. The lever 90, is, therefore, caused to oscillate in a horizontal plane in synchronism with the rocker arm 10. The lever 90, carries buffers 94, which are adapted to engage adjustable set screws in the free ends of tappet arms 95. The oscillation of the lever 90, causes a similar motion to be imparted to the tappet arms 95, about the vertical pins 96, to which they are secured. The pins 96, extend through bed plate 1, and terminate at their tops in bearing brackets 97. Arms 98, are secured to the pins between the top of the bed plate 1, and the bearing bracket 97, and their outer ends are connected by means of links 99, to the bottom cross bar 100, of a yoke 101, which comprises also a top bar 102, and the side bars 103, and 104, and is subject to the action of a spiral spring 105. (See Fig. III). The said side bars are loosely mounted at 106, and 107, on a horizontal shaft 108, whose left hand end is secured in the standard 16, and the other end in a supporting bracket 109, at the right hand end of the machine, as seen in Figs. II and VI.

The controlling drum 36, previously men-

tioned, is loosely mounted upon the shaft 108, directly adjacent to and at the left of the side bar 104, of the yoke 101. (Figs. I and II). To the left side of the drum 36, is secured a ratchet wheel 111, which is adapted for intermittent rotation, owing to the teeth omitted at 112, 113, 114, 115 and 116. The ratchet is operated upon by a pawl 120, which is loosely pivoted between collars 121, upon a cross rod 122, whose ends are secured in the side bars 103 and 104, of the yoke 101. (See Fig. VIII). A guard 123, which extends over a portion of the periphery of the ratchet wheel 111, prevents excessive pawling thereof, which would otherwise occur, owing to the extent of motion of the yoke 101.

Loosely mounted between the side arm 103, of the yoke 101, and the ratchet wheel 111, is a second ratchet wheel 125, which is disposed between, and supplemented by the cam wheels 82, and 84, above described. The cam projections of the cam wheel 82, which are symmetrically spaced, operate upon the rollers 80, 81, on arms 78, and 79, which are respectively secured to the rock shafts 76, and 77, effecting the motion of the jacks, as already described. This cam wheel 82, is used in knitting the greater portion of the stocking, as will be better understood in the description of the operation of the machine. The cam wheel 86, above described is also secured to the loose sleeve, upon the shaft 108, and is identical with the cam wheel 84, to the right of ratchet wheel 125, in that its teeth are spaced in pairs about its periphery. Cam wheels 84, and 86, are effective during the knitting of the heel pocket of the stocking, as will be more definitely set forth hereafter. The ratchet wheel 125 is adapted to be picked by a pawl 129, also mounted between a pair of collars 130, upon the cross rod 122, of yoke 101.

During a portion of the knitting of the seams at the toe and also that at the region of fashioning of the stocking, the needles at the side of the machine, shown in Fig. I, are used alone. In order to permit this, the ratchet wheel 125, is rendered idle by the temporary lifting of its pawl 129, in the following manner: A pin 131 (see Fig. VII), extends laterally from the pawl 129, and is adapted to be raised by means of a dog 132, which is pivoted to an extension arm 133, of the roller arm 83, at the right hand end of the shaft 78, already mentioned. Normally the dog 132, is actively suspended by means of a guard wire 135, which rests upon the reduced portion 136 of the cross rod 122, supported by the yoke 101.

The dog 132, consists of two parts 137, and 138. The part 138, is bifurcated to receive the part 137, and is pivoted thereto by means of a screw 139. The free end 140 of the part 138, is curved and adapted to engage the pin 131, extending from the pawl 129, and thereby raise it to render it inactive when the cam plate 141, depending from part 137, is engaged by either of the segments 142, or 143, carried on the left side of the ratchet wheel 111. A flat spring 145, is secured to the bottom of the part 137, of the dog 132, and exerts pressure upon the other part 138. A pin 146, on part 137, and notches 147, in the sides of the part 138, coact with spring 145, to keep the said two parts of the dog 132, normally in alinement, but permit them to yield when the cam plate 141, is acted upon by either of the segments 142, or 143, on the ratchet wheel 111, already described. The part 138, of the dog 132, is also provided near its free end with a notch 148, which is adapted to engage the reduced portion 136, of the cross rod 122, of the yoke 101, which is clearly shown in Figs. VII and VIII. When the dog 132, is raised, the pawling of the ratchet wheel 125, is stopped, and the oscillation of the yoke 101, is imparted through the arm 133, to the shaft 76, and the knitting takes place only on the side of the machine shown in Fig. I. When this portion is knit, the shafts 76, and 77, are shifted to the left by means of a lever 150, whose upper end is bifurcated to embrace a tie rod 151, whose ends are secured to collars on the said shafts 76, and 77. See Figs. I and II. The lever 150, is secured to a pin 152, which is capable of being shifted within a bearing bracket 153, (see Fig. V). A spring 154, serves to keep the end of the pin 152, in contact with a rotatable cam 155, on a countershaft 156, journaled in brackets 157, depending from the bottom of the bed plate 1. When the pin 152, is permitted to drop into the slot 158, of the cam 155, the spring 154, causes the lever 150, to be drawn toward the bracket 153. The lower portion 159, of lever 150, is thereby brought into the path of a cam plate 160, which is secured to the hub of the eccentric 7, on the main shaft 3.

The engagement of the cam plate 160, with the lower end 159, of the lever 150, causes its upper end to shift the shafts 76, and 77, to the left, so their respective roller arms 78, and 79, are retracted from the path of the cam wheel 82. The shaft 76, after shifting will be subject to the action of the cam wheel 84, upon its arm 83. Similarly shaft 77, will be subject to the action of cam wheel 86, upon the roller 85, on the left side of arm 79. In order to restore the shifting mechanism to its normal position, the high portion of cam 155, operates to push the lever 150, so that a cam plate 165, at the back of its lower end 159 (Fig. I), is brought into the path of a pin 166, carried upon the side of eccentric 7. The lower end of the lever 150, is thereby pulled toward the main shaft 3, and results in the shifting of the

shafts 76, and 77, to the right to restore the parts to the position illustrated in the drawings.

V. The measuring chain.—Referring more particularly to Figs. I, II, VI and VIII, near its top, the rocker arm 10 carries a tappet plate 170, adapted to engage the arm 171 of a bell crank lever 172, which is fulcrumed between two collars on a vertical post 173, projecting up from the bed plate 1. The other end 175, of the bell crank lever 172, is in constant engagement with an arm 176, which is loosely mounted upon a shaft 177, projecting laterally from a bracket 178, which is bolted to the bed plate 1, of the machine.

An arm 176, carries at its free end a pawl 179, and is normally retained in the retracted position shown in the drawings, by means of a spiral spring 180. Directly adjacent to the left of arm 176, (Figs. I, XIX and XX) a ratchet wheel 181, is also mounted loosely upon the shaft, and is acted upon by the pawl 179, which also serves to pick a second ratchet 183, when permitted by the deep spaces 184, and 185, in the ratchet wheel 181 (Fig. XX). It will thus be seen that for every ten complete reciprocations of the machine, the ratchet wheel 183, will be pawled one tooth.

The smaller ratchet wheel 183, is cast integral with a sleeve 182, which is adapted to rotate about the shaft 177, and is retained in position thereon by means of a collar 186. A sprocket wheel 187, is also cast integral with the sleeve 182 (see Fig. XIX), and supports a measuring chain 189, which in the present instance consists of sixty-five links, but this number may be varied according to the length of stocking that is to be knit.

The teeth of the sprocket 187, are related to the teeth of the ratchet 183, respectively in the ratio of one to two, and it is, therefore, obvious that the chain is moved the distance of a link for every two picks of the ratchet wheel 183, or every complete revolution of the ratchet wheel 181.

The measuring chain 189 comprises special knitted links 190, 191, 192, 193, and 194, which respectively engage a series of pins 195, 196, 197 198 and 199 mounted upon the periphery of the drum 36, already mentioned, and thereby control the timing of the formation of the toe, heel and fashioning of the leg of the stocking in a manner which will be described in connection with the operation of the machine.

VI. The fashioning mechanism.—Extending laterally from the hub of the eccentric 7, is a pin 200, which is connected through a universal joint to a link 201, which is similarly connected to an arm 202, secured to a rock shaft 203, which extends from the center of the machine to the left hand end, as viewed in Figs. I, II and III, and is journaled in brackets 205, depending from the under side of the bed plate 1.

An arm 206, secured to the shaft 205, near its left hand end, carries a pivoted block 207, which engages a slot 208, in a depending arm of a link 210, whose extremities are pivoted at 211, and 212, to oscillating arms 213, and 214, which are loosely mounted upon the worm shafts 215, and 216, respectively. The said worm shafts are journaled in brackets 217, and 218, respectively, bolted to the top of the bed plate 1, (see Fig. II).

The mechanisms for rotating the worm shaft are two in number. These mechanisms are identical but highly complicated, and had, therefore, better be described separately. Beginning with the one on the right side, which operates the side of the machine illustrated in Fig. II, the oscillating arm 213, already described plays (see Fig. XVII) between a pair of lugs 219, on the back of a drum 220, which is also loosely mounted upon the worm shaft 215, see Figs. XVI, XVII and XVIII. The back of the drum 220, is extended so as to form a flange 221, which serves at that end to retain a series of ratchet rings 222, 223, 224, 225 and 226, which are adapted to revolve upon the face of drum 220. At the other end of drum 220, the rings 222, to 226 inclusive, are retained by the overlapping portion 227, of a bearing plate 228, screwed to the edge of said drum, and a second plate 229, which extends from the worm shaft 215, upon which it is loosely mounted, extends slightly beyond its periphery. Plate 229, is also screwed at 230, to the edge of the drum 220. (See Fig. IV.)

The first three of the series of ratchet rings, namely 222, 223 and 224, are adapted for rotation in a counter-clockwise direction by means of a pawl 231, and the remaining two in a clockwise direction, by a similar pawl 232. Pawls 231, and 232, are loosely mounted upon a stud 233, which is secured to the free end of oscillating arm 213, and extends to a similar arm 234, adjacent to the opposite side of drum 220, and which is also loosely mounted upon the arm shaft 215. The ratchet rings 222, 223, 224, 225 and 226, are respectively provided with blank spaces 235, in which the pawls 231, and 232, play idly during the inactivity of the rotating mechanism. Ratchet rings 222, to 226, are also respectively provided with high teeth 236, whose purpose will be later described.

As shown in Figs. XVI to XVIII, inclusive, the drum is hollow for the reception of oppositely disposed ratchet pinions 239, and 240, which respectively pawled under the control of the two groups of ratchet rings 222, 223, 224, 225, and 226, respectively.

By means of ratchet pinion 239, the worm shaft 215, is rotated in a clockwise direction, and in the opposite direction by the pinion 240. The pawls 250, 251, 252, 253 and 254, effecting the motion of ratchets 239, and 240, correspond respectively in number to the ratchet rings 222, 223, 224, 225 and 226, and are likewise grouped.

Pawls 250 to 254, inclusive, are pivoted upon a stud 255, extending from the back of drum 220, and terminating in the bearing plate 228, already described, and best seen in Fig. XVI. The said pawls are provided with fingers 256, on the opposite sides of their pivotal point. These fingers are adapted to be engaged by notches 257, in the inner peripheries of the cam rings 222 to 226, inclusive, respectively. When these fingers are permitted to drop into the said notches under the influence of springs 258, on the pawls 250, to 254, inclusive, the opposite ends of the said pawls move into the path of the ratchet pinions 239, and 240, and thereby engage them in a manner and in the order, as will be explained in connection with the operation of the machine.

Adjustable stops 260 and 261, are secured to the outer edge of drum 220, and respectively coöperate with abutting buffers 262 and 263, respectively, which are bolted to the top of bed plate 1. The extent of effectiveness of rings 221, and 222, is limited by a guard 265, which extends over a portion of the periphery of ratchet 239. By this means, pawls 251, and 252, are permitted to pick said ratchet only one tooth at a time, while the unguarded pawl 250, picks two teeth at a time. The guard 270, which affects pawl 254, of the other group, also limits the picking of the ratchet 240, to one tooth at a time, while the other or unguarded pawl 253, is permitted to pick two teeth at a time.

The just described features are made use of during the formation of the heel pockets, and correspond in function to the devices controlling the action of the pickers in ordinary knitting machines.

Refeiring to Fig. VI, a series of projections 275, 276, 277, 278, 279, 280, 281 and 282 also are mounted upon the controlling drum 35, and are adapted to engage a cam finger 283, pivotally mounted on a bracket 285, at the right hand end of the machine (Fig. I). See also Figs. VI and VIII. An arm 286, extending substantially at right angles from the said finger 283, is connected by means of a link 287, which passes through an aperture 288, in plate 1, to a plate 289, mounted loosely upon countershaft 156, already referred to. The plate 289, is held in place between a collar 290, and a ratchet wheel 291, which are both fixed upon the shaft 156, and carries at the end of its arm 292, a pawl 293, which is adapted to engage the said ratchet 291, and imparts thereby its motion to the said shaft 156. A spiral spring 295, serves to return the plate 289, to its active position after each pick of the pawl 293.

Near the left hand end of the machine (Figs. I, III and IV) a trip wheel 296, is secured to the shaft 156, and is adapted to engage a cam lug 297, on a trigger plate 298, which is pivoted on a bracket 299, depending from the under side of bed plate 1. Between the rocker arm 206 and collar 300, the shaft 203, loosely supports a lever 301, whose lower end 302, is provided with a pin 303, adapted to engage notches 304, and 305, in the free end of trigger plate 298. The said trigger plate is maintained in contact with pin 303, by means of a tension spring 306, which is secured to a lug 307, extending from lever 301. When the trigger plate 298, is trapped by one of the projections on the wheel 296, a spiral spring 310, acting upon the upper portion 311, of lever 301, causes the pin 303, in its lower end 302, to drop from the position shown in the drawings, into the notch 305. This allows the upper end of the lever 301, to move far enough to the left (Fig. IV) to move a pin 312, carried on the back thereof into the path of the oscillating arm 206.

During the engagement of the oscillating arm 206, and co-acting pin 312, the lower end of the lever 301, is moved to the left, so that the action of the spring 306, becomes effective in restoring the engagement between the pin 303, on said lever, and the notch 304, in the end of trigger plate 298, as shown in Fig. IV. The upper end 311, of lever 301, is slotted at 313, and engages a pin 314, which projects laterally from a link 315, whose ends are pivotally connected to pawl arms 316, and 317, which are loosely mounted upon respective shafts 318, and 319, on opposite sides of the machine.

The parts carried by the shafts 318, and 319, are identical on each side of the machine: therefore to avoid duplication in description, one side will be described alone, as before, it being understood that the corresponding parts on the opposite sides, are substantially similar in operation.

The shaft 318, is journaled in brackets 320, and 321, which extend up from the bed plate 1, and are secured thereto. The arm 316, already described, is loosely mounted upon the left hand end of the shaft 318 (Figs. I and II) between the bearing on the bracket 320, and a ratchet wheel 322, which is secured to said shaft. The arm 316, pivotally supports at its upper end a spring pressed pawl 323, which is adapted to engage ratchet wheel 322, to rotate the shaft 318. A spring 325, acts upon the teeth of the ratchet 322, and prevents accidental slippage.

Mounted upon the shaft 318, are a pair of wing spiders, comprehensively indicated at 326, and 327, respectively. Spider 326, comprises a pair of hubs 328, and 329, which are slidably mounted upon the shaft by means of keys that engage the slot 330, therein. These hubs are provided with radial flaps, to which are secured the depressing wings or fashioning plates 331, 332, and 333, which operate upon the pivoted needle jacks 55, as will be more definitely described later. The spider 327, also comprises two hubs 335, and 336, which respectively carry radial flaps, to which are secured fashioning plates 337, 338, 339, 340 and 341, which also operate upon the needle jacks during the several fashioning steps necessary in the formation of a stocking. The hubs 328, and 336, of the spiders 326 and 327, are respectively rotatably secured in the upper ends of arms 345, and 346, which are provided at their lower ends with bosses 347, and 348, within which the oppositely disposed worms 349, and 350, on the shaft 215, operate.

Arms 345, and 346, are adapted to be moved backward and forward by means of the worms 349, and 350, relatively in contrary directions, to vary the number of needles in fashioning, as will be described later. In order to more rigidly support the arms 345, and 346, during their motion, they are provided with set screws 351, and 352, which are adjustably supported in plates 353, and 354, projecting from them, and roll upon balls 355, which follow a groove 356, formed in the top of bed plate 1, as best seen in Fig. V. A bracket 360, bolted to the bottom of the bed plate 1, is provided with a cross bar 361, which is located directly under the drum 220, already described. Slidably mounted upon the cross bar 361, are a series of tripping blocks 362, 363, 364, 365 and 366, which as best seen in Fig. XVII, are provided with pins 367, forced against the said cross bar by means of springs 368, and which are arranged to be retained in their uppermost positions by the engagement of the ends of said pin 367, with the detent recesses 369, in the side of the bar 361. By this means, the said blocks remain in whatever position placed. The blocks 362, 363, 364, 365 and 366 are provided at their bottoms with cam ribs 370, which are adapted to be engaged by a series of corresponding cams 371, 372, 373, 374 and 375 on the shaft 156.

When the shaft 156, is rotated to bring the cam 371, into engagement with the trip block 362, the latter is raised into the path of the high tooth 236, of the ratchet ring 222. In the oscillation of the drum 220, in a clockwise direction, the upper edge, of the block engages the high tooth 236, in the ratchet ring 222, so that the blank space 235, of the said ring is slightly advanced to permit the picking of the [illegible] cam ring by the pawl 223. The other trip blocks act in the same manner upon the remainder of the ratchet rings, and further description will, therefore, be unnecessary. In order to operate the similar trip blocks on the other side of the machine, shaft 156, is provided with a [illegible] pinion 380, which meshes with a similar pinion 382, on a shaft 383, which is journaled in brackets 384, depending from the bed plate 1. The other end of the shaft 383, carries the bevel pinion 385, which imparts motion to the co-acting pinion 386, upon the shaft 387, on the other side of the machine.

To the bottom edge of the needle bed 17 (Figs. XII and V) is pivoted a plate 390, having a raised portion 391, which during the knitting of the heel of the stocking retains a number of the jacks 55, in their raised position, and their corresponding needles, which are used only in the fashioning of the leg of the stocking, are thereby rendered idle. The shifting of the shaft 76, during the stage of the knitting already mentioned, causes the cam 392, carried on the end of the tie rod 151, to engage the notch 393, in the bottom edge of plate 390, to raise the said plate to perform the function just stated.

The parts just described are, of course, duplicated upon the other side of the machine, the corresponding elements operating in substantially the same manner.

VII. The stitch cam carriage.—As best shown in Fig. XI, the carriage 399, comprises a pair of cam bars 400, and 401, which are connected at their ends by means of yokes 402, and 403, to which they are secured. The cam bar carriage 399, is adapted to be reciprocated by means of the rocker arm 10, the top end of which is connected by means of a link 404, with the yoke 403, at the right hand end of the machine, as seen in Fig. I. The cam bars 400, and 401, are guided in their motion in guides 405, 406 and 407 and 408, which are respectively screwed to the end standards 15, and 16, which support the needle beds.

VIII. The stitch cams.—Each of the cam bars 400, and 401, is provided with a stitch cam, and as these cams are identical on each side of the machine, the description will be confined to one of them,—preferably that shown on the side of the machine illustrated in Fig. I. Referring now particularly to Figs. XIII to XV inclusive, the bar 400 is provided at its middle point with a stitch cam 410, which is capable of vertical movement, being guided between a pair of supplemental cams 411, and 412, as shown in Fig. XIV. The upper needle hubs are normally maintained at the level of the top of a guard cam 413, which is secured to the

bar directly beneath the stitch cam. For the remainder of the lengths on each side of the stitch cam, the bar 400, is provided with a comparatively wide groove 415. In the process of knitting according to my invention, the needles knit only when their upper butts 51, are raised by means of their respective jacks 55, into the path of the stitch cam 410, whereupon they are drawn down, thereby to form stitches, and thereafter so remain until again acted upon by the said jacks. This "lifting" of the needles is accomplished at the end of the strokes of the machine, when the wide grooves 415, of the cam bar 400, on each side of the stitch cam, are shifted to the region of the action of the needles.

The stitch cam 410, is secured by means of screws 416, to a sliding plate 417, on the outside of the bar, and is spaced therefrom by means of sleeves 418, which surround the said screw 416, and play within slots 419, in the back of the bar 400. The plate 417, is moved between guides 420, and 421, on the outside of the bar, and is provided with a lateral projection 422, which supports a pair of set screws 423.

Pivoted at 425, to the outside of the bar, is a lever 426, whose outer end plays within the guide bar 421, and is normally held against a stop 427, by means of a tension spring 428. The slide plate 417, is subject to the action of a spring 430, secured to an arm 431, depending from the lever 426, and the screws 423, are thereby constantly held in contact with a rotary cam 432, which is secured to the back of a ratchet pinion 433, loosely mounted upon a stud 434, screwed into the lever 426.

Rotation of the ratchet 433, will cause the raising and lowering of the stitch cam, depending upon the action of the high and low portions 435, and 436, respectively, upon the screws 423, carried by the projection 422, of the slide plate 417. A spring 437, mounted upon the end of the lever 426, acts as a brake for the ratchet pinion 433, and thereby prevents any accidental displacement thereof. The raising of the cam 410, places this cam in the proper position for starting the first stitches at the toe on the new stocking as will be explained later. At its free end, the arm 431, depending from the lever 426, carries a roller 438, which during the formation of the heel rides upon the raised or idle jacks 55, so as to elevate the lever 426, and, therefore, the stitch cam 410, by reason of its connection therewith, prevents the stretching of the loops held upon the idle needles during that stage of the process of knitting.

IX. The sinkers and the sinker cam bar carriage.—The sinkers, of which there are two sets, one on each side of the machine to correspond to the division of the needles, are pivotally mounted upon rods 445, 446, which extend respectively within slots 447, 448, cut into the sinker bars 449, 450, which are secured to the needle beds 17, and 18. The sinkers here shown perform a double function, first that of holding the web by means of their nubs 451, and 452; and second, of guiding the web by means of their curved noses, as indicated at 453, 454. The sinkers are oscillated about their pivots by means of their tails 455, which are operated upon by the cam grooves 456, 457, in their respective cam bars 458, 459. See Figs. V, and XI.

The cam bars 458, 459, are coupled at their ends by means of connecting plates 460, and 461. It will be remembered that the cam bar 458, is guided in the sinker bar 449, which is secured to the movable needle bed 11. The sinker cam bar 458, is, therefore, not permanently secured to the connecting plates 460, 461, but is provided with slots, which are respectively engaged by blocks 462, and 463, screwed to the said plates 460, and 461.

Secured to the center of the sinker cam bar 458, is a bracket 465, which adjustably supports the thread feed 466, having a guide hole which may be supplied from any suitable bobbin, not shown in the drawings. (See Figs. I, V, X and XIII). The said sinker cam bars 458, 459, also carry at their centers, vertically projecting plates 467, and 468, which are slotted to receive pins 469, 470, projecting from slide blocks 471, 472, respectively. These blocks slide and are guided upon rods 473, and 474, which are respectively secured to the sinker bars 458, and 459. Screwed to the blocks 471, and 472, are latch openers 475, and 476, having cam nibs 477, 478, which in their motion protrude under the latches of the needles, and thereby open them in readiness to take the thread.

Coöperating respectively with the latch openers 475, and 476, are leveling bars 498 and 499. These bars extend longitudinally the full length of the needle bed and have a beveled edge, see Fig. V. The leveling bar 499 has a beveled edge in line with the needles 51, when they are raised and serves to bring all the needles absolutely in a direct line and the proper distance from the point of the latch opener. This avoids any possibility of the latch opener striking the needles and bending or breaking the same. The leveling bar 498, operates in a similar manner in connection with the needles on the other side of the machine. The leveling bar 499, is attached to the sinker bar 449, while the leveling bar 498, is attached to the sinker bar 450. By this arrangement the leveling bars will maintain the same relative position to the needles, regardless of the position of the needle bed plates. The sinker cam bar carriage 480, is adapted to move in synchronism with the stitch cam

carriage 399, except when the work is to be pressed off by means of a certain mechanism which will be described later. A certain amount of lost motion is, however, necessary between these two carriages to permit the thread feed to be at all times in the lead of the stitch cams, and this is accomplished by the parts about to be described.

Referring more particularly to Figs. X, and XI, the connecting yokes 402, and 403, of the stitch cam carriage 399, are provided respectively with bifurcated depending lugs, between which are pivoted dogs 481, and 482, as indicated at 483, and 484. Set screws 485, and 486, respectively, playing in slots in the tops of the yokes 402, and 403, limit the amount of motion of the dogs 481, and 482, respectively. When the stitch cam bar carriage 399, moves to the left, as shown by the arrow in the drawings, the notch 487, on the dog engages a block 488, on the connecting plate 461, of the sinker cam bar carriage, which is, therefore, moved until the cam incline 489, on the end of the dog 482, strikes the top of an adjustable lifting plate 490, which is mounted upon a bracket 491, projecting from the end standard 16, as best shown in Fig. X. As soon as the engagement between the dog 482, and the block 488, is broken, the sinker cam bar carriage 480, comes to rest, while the stitch cam bar carriage completes its stroke in that direction. In the return stroke of the stitch cam bar carriage, the notch 492, on the dog 481, engages a block 493, on the connecting plate 460, already mentioned, which causes the sinker cam bar carriage to be moved until the dog 481, is tripped by a lifting plate 495, which is secured to the bracket 496, on the standard 15. The sinker cam bar carriage 480, thereupon comes to rest, while the stitch cam bar carriage 399, completes its return motion in a manner precisely the same as that before described. A cursory examination of the drawings will show that by this means the thread feed 466, will be kept constantly in advance of the stitch cams, no matter what the direction of reciprocation.

In order to permit the pressing off of a finished stocking, the sinker cam bar carriage 480, and, therefore, the thread feed 466, carried thereby, is rendered idle for a double reciprocation of the machine, which corresponds to a course of knitting, by means of the parts about to be described. A rock shaft 500, extends longitudinally across the machine, and is journaled in standards 15, and 16, and carries at its right hand end a cam finger 501, which is adapted to be engaged by a cam 502, also mounted upon the periphery of the controlling drum 36, see Figs. I and VI. Mounted upon the shaft 500, between the standard 16, and the finger 501, is a tappet arm 503, which engages a spring-pressed slide rod 505, which is guided in a bracket 506, secured to the guide 407, for the stitch cam bar 400. The upper end of the slide rod 505, is adapted to engage a collar 510, on the right hand end of a rod 511, which extends between and is slidably mounted in bosses 512, and 513, cast integral with the connecting yokes 402, and 403, of the stitch cam bar carriage. The rod 511, at its left hand end is provided with a laterally projecting pin 515, which is adapted to engage a cam hook 516, on the top of the dog 481. The rod 511, is normally maintained in the position shown in the drawings, by means of a pin 517, extending from the left hand end of the sinker bar 449, as best shown in Fig. I, which engages a collar 518, on the left hand end of the rod 511.

When it is desired to "press off" the work from the machine, the engagement of the cam 502, on the drum 36, with the finger 501, causes the slide rod 505, to be moved into the path of the collar 510, on rod 511. This causes the pin 515, to be shifted under the cam hook 516, on the dog 481, thereby breaking the engagement between the stitch cam carriage and the sinker cam carriage, whereby the latter remains idle for a double reciprocation of the machine, which corresponds to a course of knitting. It will be remembered that the thread feed is carried by the sinker cam carriage, and that, therefore, no thread would be fed to the needles during this "pressing off" operation of the machine.

X. Mechanism for raising and lowering the stitch cams.—The drum 36, is provided upon its periphery with cams 525, and 526, which operate upon a finger 527, secured on a shaft 528, (see Fig. VI), which is journaled in the end standards 15, and 16, which support the needle beds. At the opposite ends of the machine (Fig. IV) a tappet finger 529, is secured upon the shaft 528, and engages a similar finger 530, on a second shaft 531, journaled in the end standards. The motion thus imparted to the shaft 528, by reason of these connections, is transmitted to the shaft 531. The said shaft 531, is on the side of the machine shown in Fig. I, and supports a tappet arm 532, which engages a rod 533, slidably mounted in a bracket 534, extending from the cam bar guide. The upper end of the rod 533, engages the tail of a dog 535 (Fig. I), which is spring pressed and pivoted at 536, to the said bracket. When the rod 533, is raised by the motion of the shaft 531, the free end of the dog is moved into the path of the ratchet pinion 438, thereby rotating the cam 432, attached thereto in a manner already described, and which ultimately results in the raising and lowering of the stitch cam. As shown in Fig. VI, the shaft

528, also supports a tappet finger 540, which engages a slide rod 541, mounted in a bracket 542, extending from the slide bracket 408, for the cam bar 401. The rod 541, also engages a dog 543, similar to the dog 535, already described, which performs a like function in the operation of the stitch cam on the opposite side of the machine.

XI. Operation of the machine.— In the operation of the machine, during the knitting of the last course at the top of the finished stocking, the pattern chain engages the change drum and turns it sufficiently so as to bring the pawl carried by the oscillating yoke into engagement with the ratchet teeth on the change drum. The change drum will then be rotated until another blank tooth comes under the operating pawl. The rotation of the change drum brings the cam 502, into engagement with the finger 501, which oscillates the rock shaft 500, and through the tappet arm 503, lifts the rod 505, into the path of the collar 510, on the rod 511. The rod 511, through the pin 515, lifts the locking dog 481, from engagement with the sinker cam carrier, so that on the next reciprocation of the stitch cam carriage, the sinker cam carriage remains idle, and also the thread carrier which is mounted thereon. This reciprocation of the stitch cam carriage depresses all the needles and presses off the finished stocking from the machine. At the end of this reciprocation, the oscillation of the rock shaft 528, will throw the dog 535, into the path of the ratchet wheel 433, controlling the cam 432, which shifts the stitch cam 410, up and down, putting the stitch cam in the proper position for starting the first row of stitches at the toe of the next stocking. The thread carrier and latch opener, however, are again picked up by the stitch cam carriage on the next double reciprocation as the continued rotation of the change drum causes the rock shaft 500, to return to its normal position. As the stitch cam carriage reciprocates, the latch openers lift the latches of the needles preparatory to beginning the next stocking.

The continued rotation of the change drum, causes one of the pins 88 or 89, to engage the finger 87, carried by the rock shaft 77; which lifts the needles at the rear of the machine as viewed in Fig. I, to a position slightly above the hooks of the needles on the opposite side of the machine, which are at this time normally raised. The thread carrier as it reciprocates, lays the thread into the hooks of the needles both at the front and the back of the machine, and, therefore, the stitches are hooked on to the needles used in knitting the foot of the stocking on both the needle beds. This forms a setting-up course to begin the automatically closed toe of a new stocking. On the movement of the carriage in the opposite direction, the needles at the rear of the machine drop to a position slightly below the needles in the front of the machine, and remain idle in this position during several reciprocations of the stitch cam carrier.

The continued movement of the change drum lifts the pawl from the ratchet wheel, which operates the cam wheels for raising and lowering the needle jacks, so that said cam wheels become idle. The pawl-lifting arm which is connected to the rock shaft 76, is coupled directly to the yoke 101, which rotates the change drum, and the vibrations of this yoke will raise and lower the needle jacks 55, at the front of the machine, and a plurality of courses will be knit upon these needles, and at the same time cam 410, will be brought down to its normal position. This same movement of the change drum will bring a space between the cam plates 34, and 35, in front of the finger 33, and allow the same to move toward the change drum, which in turn allows the spring to raise the needle bed at the front of the machine, to bring the knitting position of the needles closer to said idle needles holding the first course of stitches and this positioning of the needles occurs before the knitting of the courses forming the strengthening gore thus enables the stitches, throughout the entire toe to be made of equal length, and to form a toe wherein there in practically an invisible starting point. This same movement of the change drum also operates through the shaft 156, and its connected parts, to rotate the fashioning plates which control the needle jacks, so that only the needles which are used to knit the foot of the stocking are thrown into action, both at the front and the rear of the machine. In the present machine, I have arranged to knit six courses on the needles at the front of the machine as viewed in Fig. I, but this number of courses may be changed to any number desired to suit the work being knit. These six courses form what I term the strengthening gore for the toe of the stocking.

As soon as the parts are positioned for the knitting of the six courses above referred to, the change drum becomes idle, and remains so until the six courses are finished. The pattern chain will then again turn the change drum to throw the same into action, and a rotation of the same will release the pawl-lifting arm from the yoke, and set into action the ratchet wheel for rotating the cam wheels which lift the needle jacks. This same movement of the change drum will operate through the shaft 156, to again rotate the fashioning plates, so that all the

needles are rendered idle or thrown out of action, still, however, retaining their stitches, except the central needles on both beds, which are used in the forming of the end of the toe. This rotation of the shaft 156, will also throw into action the ratchet rings which control the worm shafts, and as the machine proceeds with the knitting, the worm shafts will be rotated, which will gradually separate the fashioning plates longitudinally, and throw into action two needles, first on one side and then the other of the mach. for each complete reciprocation thereof. The number of needles, however, which are thrown into action, may be varied, and, thereby the shape of the toe changed at will. By thus throwing into action two needles, first on one side and then the other, a gradual widening of the toe will be accomplished, and a tube will be knit in which the widening stitches are united with the outside stitches of the previously formed gore which is held by the idle needles.

After the finishing of the toe, the foot of the stocking is knit by the normal operation of the machine, the needle jacks first on one side and then the other being lifted by the cam wheel 82. When the heel of the stocking is reached, the pattern chain again turns the change drum, so that a pin on the change drum engages and rotates the shaft 156, which throws the lever 150, into action, and this lever in turn will shift the rock shafts which raise and lower the needle jacks, so that the rollers carried thereby are brought into engagement respectively with the cam wheels 84, and 86. These needle-lifting fingers are so constructed and arranged relative to each other, as to lift the needles twice on the front side of the machine, and then twice on the rear side of the machine. This same movement of the change drum will also turn the fashioning plates so as to render idle one-half of the needles at the same ends of both beds used in knitting the foot; while the other half of the needles are used for the formation of the heel. The raising of the needles twice first on one side and then on the other of the machine, causes the thread carrier to lay the thread into the needles on the front of the machine in a direction toward the idle needles, and then back again away from the idle needles, thus avoiding the connecting of the two sides at the central portions of the needles. The thread is then laid into the rear needles and back again. This same movement of the change drum will also throw into action another of the ratchet rings which control the worm shafts, and as the worm shaft is rotated, a certain number of needles are thrown out of action, and then again into action at the center of the beds, so as to properly form the heel. As above noted, the ratchet rings are so controlled that one needle is affected during the rotation of the worm gear in one direction and two needles during the rotation in the opposite direction. After the heel is completed, the pattern chain again turns the change drum into action, which puts the machine back into normal position, shifting the rock shafts which lift the needle jacks, so as to bring the operating rolls into engagement with the cam wheel 82.

In order to fashion the leg of the stocking, practically the same operation takes place as in fashioning the toe. The pattern chain rotates the change drum, the fashioning plates are likewise rotated so that all the needles which are knitting, are rendered idle, and the needles only which are to be used in the widening of the leg are raised, while a thread is laid into both the needles in the front and rear of the machine, and a plurality of courses preferably six, are knitted on the needles at the rear of the machine only; after which the machine is restored to normal position, and the knitting proceeds on the regular needles which were idle, and one after another the widening needles are thrown into action, thus joining the strengthening gore at its edges with the united widening stitches.

During the knitting of the remainder of the stocking, all of the needles are in action. The change drum again controls another ratchet ring which is thrown into action to rotate the worm shaft, so as to bring the fashioning plates back into normal position for the first operation in the stocking. The stocking is pressed off as above stated.

In Fig. XII. I have shown more or less diagrammatically a stocking in which is indicated between 548 and 549, the toe of the stocking; the strengthening gore for the toe extends from the point 550 to 548, on one side of the toe and 551, to 549, on the other side of the toe. The strengthening gore in the leg of the stocking extends from the point 553, to the point 554. This strengthening gore, inasmuch as its outside stitches are united by the widening stitches, will produce a slightly ribbed effect on the outer face of the stocking at the widening portions thereof.

Having thus described my invention, I claim:—

1. In a knitting machine, the combination of straight rows of needles, mechanism for simultaneously knitting a plurality of courses of fabric for the end of the toe of a stocking and for a strengthening gore on sufficient of the needles for forming the foot of the stocking, mechanism for subsequently rendering idle all of said needles having the

knitted courses thereon, except the needles for beginning the toe, and mechanism for operating said needles having the knitted courses thereon to knit successive increasing courses and joining said courses to the knitted gore for forming the toe of the stocking.

2. In a knitting machine, the combination of two needle beds, straight rows of needles in each bed, mechanism for knitting a plurality of courses of fabric for the end of the toe of a stocking and for a strengthening gore on the needles on one bed, mechanism for subsequently rendering idle all of the needles having the knitted fabric thereon on both said needle beds, except the needles for beginning the toe, and mechanism for subsequently knitting on both needle beds and widening the remainder of the toe of the stocking and joining said widening stitches to the strengthening gore.

3. In a knitting machine, the combination of two needle beds lying in planes intersecting each other, straight rows of needles in each bed mechanism for beginning a course of fabric on both needle beds and knitting a plurality of courses of fabric on one needle bed only for the end of the toe of a stocking and for a strengthening gore on sufficient of the needles to form the foot of the stocking, mechanism for rendering all of said needles in both beds idle, except the needles for beginning the toe, and mechanism for operating all of the needles on both beds having knitted courses thereon for knitting the toe and widening the same and joining the widening stitches to said strengthening gore.

4. In a knitting machine, the combination with inclined needle beds, of rows of needles therein, mechanism for raising the needles in one bed, mechanism for raising the needles in the other bed, so that a thread may be laid into the hooks of all the raised needles and mechanism for using the needles on both beds for knitting the toe of a stocking.

5. In a knitting machine, the combination with inclined needle beds, of rows of needles therein, mechanism for raising the needles in one bed, mechanism for raising the needles in the other bed, so that a thread may be laid into the hooks of all the raised needles, means for rendering the needles on one bed idle and for knitting a plurality of courses on the other bed and mechanism for using the needles on both beds for knitting the toe of a stocking.

6. In a knitting machine, the combination with inclined needle beds, of rows of needles therein, mechanism for raising the needles in one bed, mechanism for raising the needles in the other bed, so that a thread may be laid into the hooks of all the raised needles, means for rendering the needles on one bed idle, and for knitting a plurality of courses on the other bed, and means for raising the bed on which the courses are knitted, so as to bring the knitting position of said needles close to the idle needles holding the first made stitches.

7. In a knitting machine, the combination with inclined needle beds, of rows of needles therein, mechanism for raising the needles in one bed, mechanism for raising the needles in the other bed, so that a thread may be laid into the hooks of all the raised needles, means for rendering the needles on one bed idle, and for knitting a plurality of courses on the other bed, means for raising the bed on which the courses are knitted, so as to bring the knitting position of said needles close to the idle needles holding the first made stitches, and means for subsequently knitting a toe of a stocking and uniting the outside stitches of the previously knitted portion with the united widening stitching of the toe.

8. The combination of inclined needle beds, rows of needles arranged therein, mechanism for laying a thread into the needles on both beds used in forming the foot of a stocking, mechanism for rendering idle the needles in one bed and for causing the needles in the other beds to knit a plurality of courses, mechanism for subsequently rendering idle all the needles carrying stitches, except the needles which form the narrow portion of the toe, and mechanism to throw in at periods one needle on the side of each bed for widening the toe.

9. In a knitting machine, the combination of rows of straight needles, means for causing said needles to knit a tube forming the leg of a stocking, and mechanism for fashioning the leg including means for knitting a strengthening gore and for subsequently uniting the outside stitches of the strengthening gore with the united widening stitches of the leg.

10. In a knitting machine, the combination of straight rows of needles, mechanism for causing said needles to knit a tube forming the leg of a stocking, mechanism for rendering said needles idle, and for raising all the needles used to widen the leg, whereby a thread may be laid into the hooks of the widening needles and a plurality of courses knitted on the widening needles on one bed, mechanism for subsequently rendering all the widening needles idle and for throwing into action the remainder of the knitting needles, and mechanism for throwing into action at periods certain of the widening needles.

11. A knitting machine including in combination, a straight row of needles, mechanism for raising simultaneously all the needles in said row, a stitch cam for depressing said needles, a latch opener, and means for raising the stitch cams whereby the needles are not depressed sufficiently to form

stitches, so that said latch openers may raise the latches preparatory to the commencement of the toe of the stocking.

12. The combination of a straight row of needles, of means for simultaneously raising all of said needles, a stitch cam for depressing said needles, a stitch cam carriage, means for reciprocating said carriage, a sinker carriage, a thread carrier mounted on said sinker carriage, dogs carried by the opposite ends of the stitch cam carriage, and adapted to engage the sinker carriage, and means for releasing the dogs, whereby the throw of the stitch cam carriage exceeds that of the sinker carriage.

13. A knitting machine including in combination, a straight needle bed, needles carried thereby, individual jacks for each needle for lifting the same, a stitch cam for depressing successively said needles, and means for reciprocating said stitch cams and means for rendering the jacks ineffective to lift the needles.

14. In a knitting machine, the combination of a straight needle bed, needles carried thereby, individual jacks for each needle for raising the same, a stitch cam for depressing the needles, and means whereby the needle-operating jacks may be moved out of the path of the needles.

15. In a knitting machine, the combination of a straight needle bed, needles carried thereby having upper and lower butts, individual jacks for each needle, adapted to engage the lower butt, raise the needle, a stitch cam, coöperating with the upper butts for depressing the needles and means for reciprocating the jacks.

16. In a knitting machine, the combination of a straight needle bed, needles carried thereby having upper and lower butts, individual jacks for each needle, adapted to engage the lower butt and raise the needle, a stitch cam coöperating with the upper butts for depressing the needles, means for controlling the needle-raising jacks, whereby said jacks may be rendered ineffective and means for reciprocating the jacks.

17. In a knitting machine, the combination of two straight inclined needle beds, needles carried thereby, jacks for raising the needles, a stitch cam for depressing the needles, a cam wheel for raising the jacks first in one needle bed and then in the other needle bed and means for controlling the needle-raising jacks, whereby the jacks may be rendered ineffective.

18. In a knitting machine, the combination of two straight inclined needle beds, needles carried thereby, jacks for raising the needles, a stitch cam for depressing the needles, a cam wheel for raising the jacks first in one needle bed and then in the other needle bed, means for rendering said cam wheel idle and for raising the jacks in one needle bed only and means for controlling the needle-raising jacks, whereby the jacks may be rendered ineffective.

19. In a knitting machine, the combination of two straight inclined needle beds, needles carried thereby, jacks for raising said needles, stitch cams for depressing said needles, a cam wheel adapted to raise the jacks in one needle bed, an independent cam wheel for raising the jacks in the other needle bed, said cam wheels having double cam projections, whereby the needles are raised twice, first in one bed and subsequently twice in the other bed.

20. In a knitting machine, the combination of two straight inclined needle beds, needles carried thereby, jacks for raising the needles, cams for depressing the needles, a rock shaft for operating each set of jacks, a plurality of cam wheels for operating said rock shaft, and means for shifting said rock rock shafts, means for shifting said rock shafts are brought into operative engagement with various cam wheels, whereby the time of lifting the jacks may be varied.

21. In a knitting machine, the combination of two straight inclined needle beds, needles carried thereby, jacks for raising the needles, cams for depressing the needles, a rock shaft for operating each set of jacks, a plurality of cam wheels for operating said rock shafts, means for shifting said rock shafts longitudinally, whereby said rock shafts are brought into operative engagement with various cam wheels, whereby the time of lifting the jacks may be varied, and a change drum for controlling the longitudinal shifting of the rock shafts.

22. A knitting machine including in combination, two straight inclined needle beds, needles carried thereby, jacks for raising said needles, stitch cams for depressing said needles, a rock shaft operating to raise each set of jacks, cam wheels for operating said rock shaft, a change drum, means operated by said change drum for rendering said cam wheels idle, means operated by said change drum for lifting one of said needle beds to raise the hooks of the needles into threading position, and means for raising and lowering the jacks of the other needle bed, whereby a thread may be laid into the hooks of the needles on both beds, and the needles on one bed only subsequently operated to knit a plurality of courses.

23. In a knitting machine, the combination of two straight inclined needle beds, needles carried thereby, jacks for raising said needles, stitch cams for depressing said needles, means for controlling the jacks, whereby said jacks may be rendered effective or ineffective for raising the needles, means for raising said jacks, including cam wheels, means for controlling said cam wheels including a change drum, a pawl for

operating said change drum, means for causing said change drum to remain idle, and a pattern chain for throwing into action said change drum.

24. A knitting machine including in combination, two straight needle beds, needles carried thereby, individual jacks for raising said needles, means for raising said jacks, means for rendering said jacks ineffective, including fashioning plates adapted to engage said jacks and to raise the same out of contact with the needles.

25. A knitting machine including in combination, two straight needle beds, needles carried thereby, individual jacks for raising said needles, means for raising said jacks, means for rendering said jacks ineffective, including a rotating shaft, a plurality of fashioning plates carried thereby and adapted to be successively brought into engagement with said jacks for lifting the same out of engagement with said needles.

26. A knitting machine including in combination, two straight needle beds, needles carried thereby, individual jacks for raising said needles, means for raising said jacks, means for rendering said jacks ineffective, including a plurality of fashioning plates arranged in longitudinal alinement, and means for moving said plates laterally across the jacks for throwing into or out of effective action a certain number of jacks.

27. A knitting machine including in combination, two straight needle beds, needles carried thereby, individual jacks for raising said needles, means for raising said jacks, means for rendering said jacks ineffective, including a rotatable shaft, a plurality of alined fashioning plates carried by said shaft, means for rotating said shaft to bring said fashioning plates into engagement with the jacks, and means for separating the alined fashioning plates.

28. A knitting machine including in combination, two straight needle beds, needles carried thereby, individual jacks for raising said needles, means for raising said jacks, means for rendering said jacks ineffective, including a rotatable shaft, a plurality of alined fashioning plates carried by said shaft, means for rotating said shaft to bring said fashioning plates into engagement with the jacks, means for separating the alined fashioning plates, said means including a shaft having oppositely wound worms, and pattern-controlled mechanism for rotating said worm shaft.

29. In a knitting machine, the combination of a needle bed, needles carried thereby, jacks for raising said needles, means for controlling said jacks, whereby the same are rendered ineffective including fashioning plates, means for moving said fashioning plates longitudinally including a worm shaft, independent ratchet rings and connecting devices for operating said worm shaft, means for rendering said ratchet rings idle, and means for throwing into action the proper ring for controlling the jacks for the different parts of the stocking.

30. In a knitting machine, the combination of a needle bed, needles carried thereby, jacks for raising said needles, means for controlling said jacks, whereby the same are rendered ineffective including fashioning plates, means for moving said fashioning plates longitudinally including a worm shaft, independent ratchet rings and connecting devices for operating said worm shaft, means for rendering said ratchet rings idle, means for throwing into action the proper ring for controlling the jacks for the different parts of the stocking, and a ratchet ring for returning said worm shaft to normal position.

31. A knitting machine including in combination, a straight needle bed, needles carried thereby, jacks for raising the needles, means for controlling said jacks, including fashioning plates, a worm shaft for moving said fashioning plates longitudinally, a ratchet ring and connecting devices for moving said worm shaft in one direction, and a ratchet ring and connecting devices for moving the worm shaft in the opposite direction, said ratchet rings operating during the formation of the heel of the stocking, and means for pawling one ratchet ring one tooth at a time, and the other ratchet ring two teeth at a time.

In testimony whereof, I have hereunto signed my name at Easton, Pennsylvania this thirty first day of October 1910.

WILLIAM EVAN CHIPMAN.

Witnesses:

ERNEST ARTHUR PIGEON,

HUGH JAMES FLEMING,

JOHN BRUNNER.

A. GEE.

ATTACHMENT TO KNITTING MACHINES FOR ORNAMENTING HOSIERY.

APPLICATION FILED MAR. 23, 1911.

1,014,753. Patented Jan. 16, 1912.

FIG. 1.

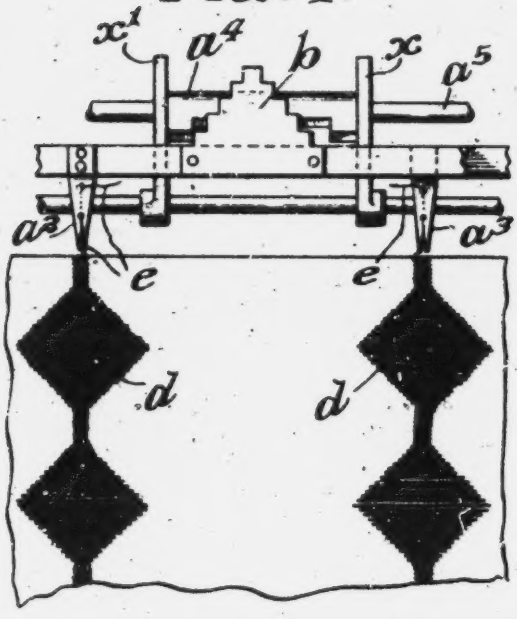


FIG. 2.

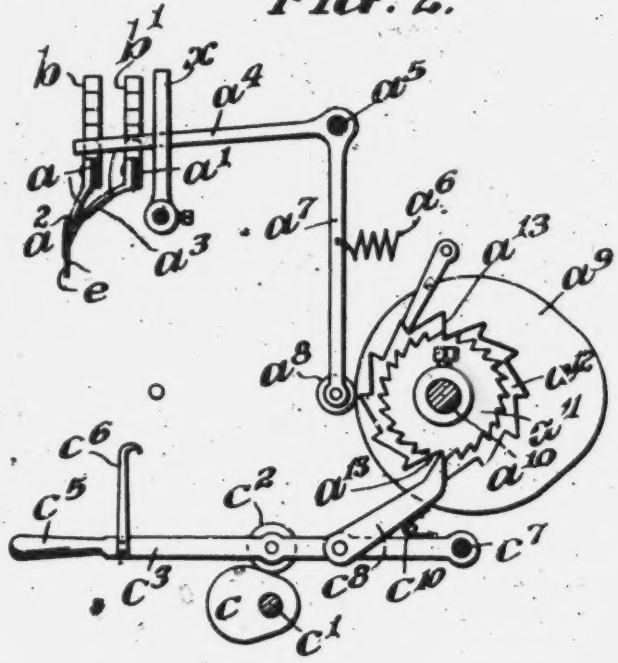


FIG. 3.

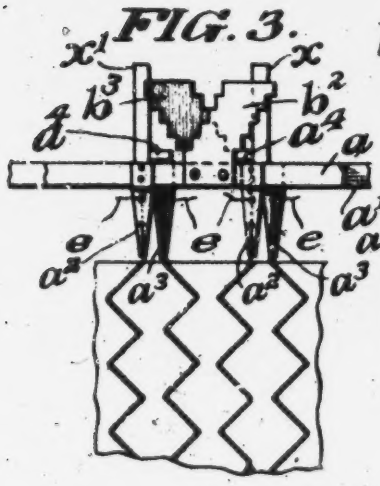
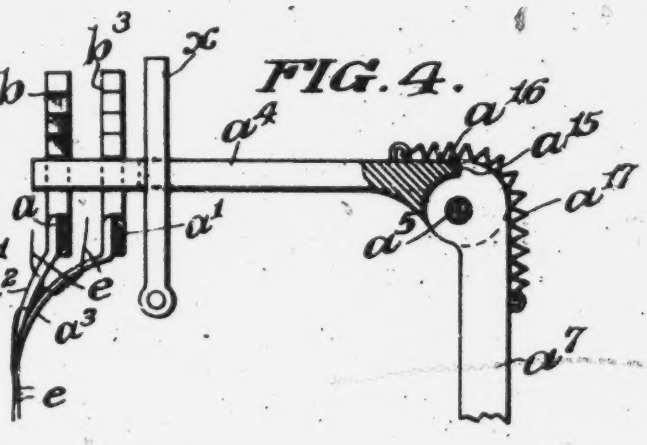


FIG. 4.



INVENTOR

Albert Gee,

WITNESSES

Thomas M. Smith

Elisha A. Shoddrake

BY J. Walter Douglas.

ATTORNEY

UNITED STATES PATENT OFFICE.

ALBERT GEE, OF PHILADELPHIA, PENNSYLVANIA.

ATTACHMENT TO KNITTING-MACHINES FOR ORNAMENTING HOSIERY.

1,014,753. Specification of Letters Patent. Patented Jan. 16, 1912.

Application filed March 23, 1911. Serial No. 616,417.

To all whom it may concern:

Be it known that I, ALBERT GEE, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Attachments to Knitting-Machines for Ornamenting Hosiery, of which the following is a specification.

My invention has relation to an attachment adapted for employment with a full fashioning flat knitting machine to variably ornament hosiery during production thereof; and in such connection it relates to the particular constructive arrangement of such an attachment to the knitting machine for the defined purpose.

The nature and scope of my present invention will be more fully understood from the following description taken in connection with the accompanying drawings forming part hereof, in which—

Figure 1, is a front elevational view of an attachment to a flat knitting machine to ornament hosiery during production, embodying main features of my said invention. Fig. 2, is a vertical sectional view of said attachment. Fig. 3, is a front elevational view of a modified arrangement of said attachment to obtain different ornamental effects in the hosiery, during production; and Fig. 4, is an enlarged sectional elevation of actuating parts of the said attachment, as shown in Fig. 3.

Referring to the drawings, a and a^1, are the reciprocating bars of a flat knitting machine provided with thread-carriers a^2 and a^3. On each of the bars a and a^1, is secured the pattern forming step-like devices b and b^1. These devices are preferably arranged in pyramidal form and so as to regulate movements of the bars a and a^1, as well as the thread carriers a^2 and a^3.

a^4, is a bifurcated bar held in guides x and x^1, of the machine. The bar a^4, as shown, is mounted on a shaft a^5, of the machine and is also provided with a depending extension a^7, held under tension by means of a spring a^6. This extension also carries a terminal roll a^8, operated by a cam a^9, with which it is held in engagement by means of a spring a^6. The cam a^9, is secured to a shaft a^{10}, of the machine. On this shaft a^{10}, is secured a ratchet-wheel a^{11}, and loosely carried on the same shaft adjacent to the ratchet-wheel a^{11}, is a second ratchet-wheel a^{12}. As shown, the teeth of these ratchet-wheels a^{11} and a^{12}, preferably differ in number with respect to each other, as clearly shown in Fig. 2, although they could be arranged each with a like number of teeth and equally good results be obtained. The ratchet-wheel a^{12}, loosely mounted on the shaft a^{10}, has a lesser number of teeth than the ratchet-wheel a^{11}, fixed to the said shaft. In the ratchet-wheel a^{12}, one or more of the teeth for example a^{13}, is deeper than the rest of the teeth of this ratchet-wheel.

c, is a cam mounted on a shaft c^1, of the machine, which, actuates a roll c^2, journaled to a bar c^3, carrying a handle c^5, and hook c^6, for lifting the same out of the way, when required, that is, when simply plain knitting, by the machine is to be done. The bar c^3, is mounted at its forward end on a shaft c^7, of the machine and between its forward pivotal connection and the roll c^2, carried thereby, is arranged a pawl c^8, in pivotal connection therewith and normally arranged to engage the ratchet-wheel a^{12}, and held in engagement therewith, by means of a spring c^{10}, until a deep tooth of said ratchet-wheel is brought into position with the same, when the said pawl engages with teeth of both ratchet-wheels of the shaft a^{10}, to revolve the latter and the cam a^9, to operate the roll a^8, of the bar a^4, and thereby cause the bifurcated portion of said bar to step up, notch by notch or down, notch by notch of the pyramidal step-devices b and b^1. These devices so arranged one in advance of the other as shown in Fig. 2, control the successive throw movements of the bars a and a^1, and also the carriers a^2 and a^3, of the ornamenting thread or yarn in producing the particular ornamental design in the hosiery and during ordinary knitting of the stocking blank, as indicated for example, at d and d^1, in Fig. 1. In the operation of the thread-carriers a^2 and a^3, the thread or yarn e, drawn therethrough and controlled by the devices b and b^1, effect the said results through the bifurcated portion of the bar a^4, being caused to successively step up notch by notch and thus to increase step by step the throw of the bars a and a^1, to gradually increase or widen the design in the stocking, while ordinary knitting of the same is going on. A reverse movement of the bifurcated bar a^4, produces a gradual narrowing of the design, in the stocking and during knitting thereof. This

is effected by the step by step movement downward of the said bar along the steps of the pyramidal devices b and b^1, shortening the throw of the bars a and a^1, as descending, as will be apparent from Fig. 1.

From the foregoing it will be understood that the action of the bars a and a^1, in connection with the devices b and b^1, induced by the operating mechanism of the machine described, will cause during knitting on a flat machine ornamental designs or configurations corresponding in shape or form to those illustrated in plan Fig. 1. Further, that in order to vary the designs, as shown, it is only necessary to change the form of the devices b and b^1, and this can be readily accomplished by simply removing the type of said devices b and b^1, of Fig. 1, from the bars a and a^1, and replacing by others having different pyramidal pattern forming conditions.

In Figs. 3 and 4, are shown, a modified arrangement of the pyramidal pattern forming devices b^2 and b^3. In this instance they are arranged in reverse relationship to each other from the respective bars a and a^1, and are engaged by the bifurcated portion of the bar a^4, and moved step-by-step upward to cause the bars a and a^1, to be moved in opposite directions and at the same time limited as to their oscillations to thus correspondingly operate the thread-carriers a^2 and a^3, manipulating the ornamenting thread or yarns back and forth rapidly to variably produce a zig-zag ornamental design, such as is shown in plan, in Fig. 3, during knitting of the hosiery on a full fashioning flat knitting machine. In Fig. 4, the bifurcated portion of the bar a^4, is pivoted to the extension a^7, and is provided with a shoulder a^{15}, which bears against an offset a^{16}, held normally in engagement therewith, by a spring a^{17}, as shown in Fig. 4. The bifurcated bar a^4, is held in contact with a set of steps of the devices b^2 and b^3, by means of the spring a^{17}. A cam a^9 causes the bar a^7, to rotate on the pivot a^8, to free the shoulder a^{15}, from the said offset a^{16}, of the bar a^4, and at the same time to bring the spring a^{17}, under such tension as that when a set of steps of the said devices b^2 and b^3, are alined under the influence of the spring a^{17}, the bifurcated portion of the bar a^4, is lifted into engagement with the set of steps of the devices b^2 and b^3, to thereby cause the bars a and a^1, to be spaced farther apart, during their oscillations and so on, in order to continue the production of zig-zag designs of the character for example, as shown in Fig. 3, during ordinary knitting of the stocking blank on the flat or straight knitting machine, in which the said devices are particularly adapted for use.

Having thus described the nature and objects of my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a knitting machine, two horizontal reciprocating bars, thread carriers supported by said bars, two step-like pattern forming devices secured to said bars and arranged one in advance of the other, a pivoted bifurcated bar provided with roller-means, said bar arranged to step up or down, notch by notch, of said pattern forming devices and a cam controlled pawl and ratchet mechanism to actuate said bifurcated bar and thereby to permit of reciprocations of said horizontal bars, substantially as and for the purposes described.

2. In a knitting machine, two horizontal reciprocating bars, thread carriers supported by said bars, two step-like pattern forming devices secured to said bars, and arranged one in advance of the other and a jointed bifurcated bar provided with roller-means, said bar arranged to step up or down, notch by notch, of said pattern forming devices, a spring connected with both members of said bifurcated bar and a cam controlled pawl and ratchet mechanism for actuating said bifurcated bar and thereby to permit of reciprocations of said horizontal bars, substantially as and for the purposes described.

In witness whereof, I have hereunto set my signature in the presence of two subscribing witnesses.

ALBERT GEE.

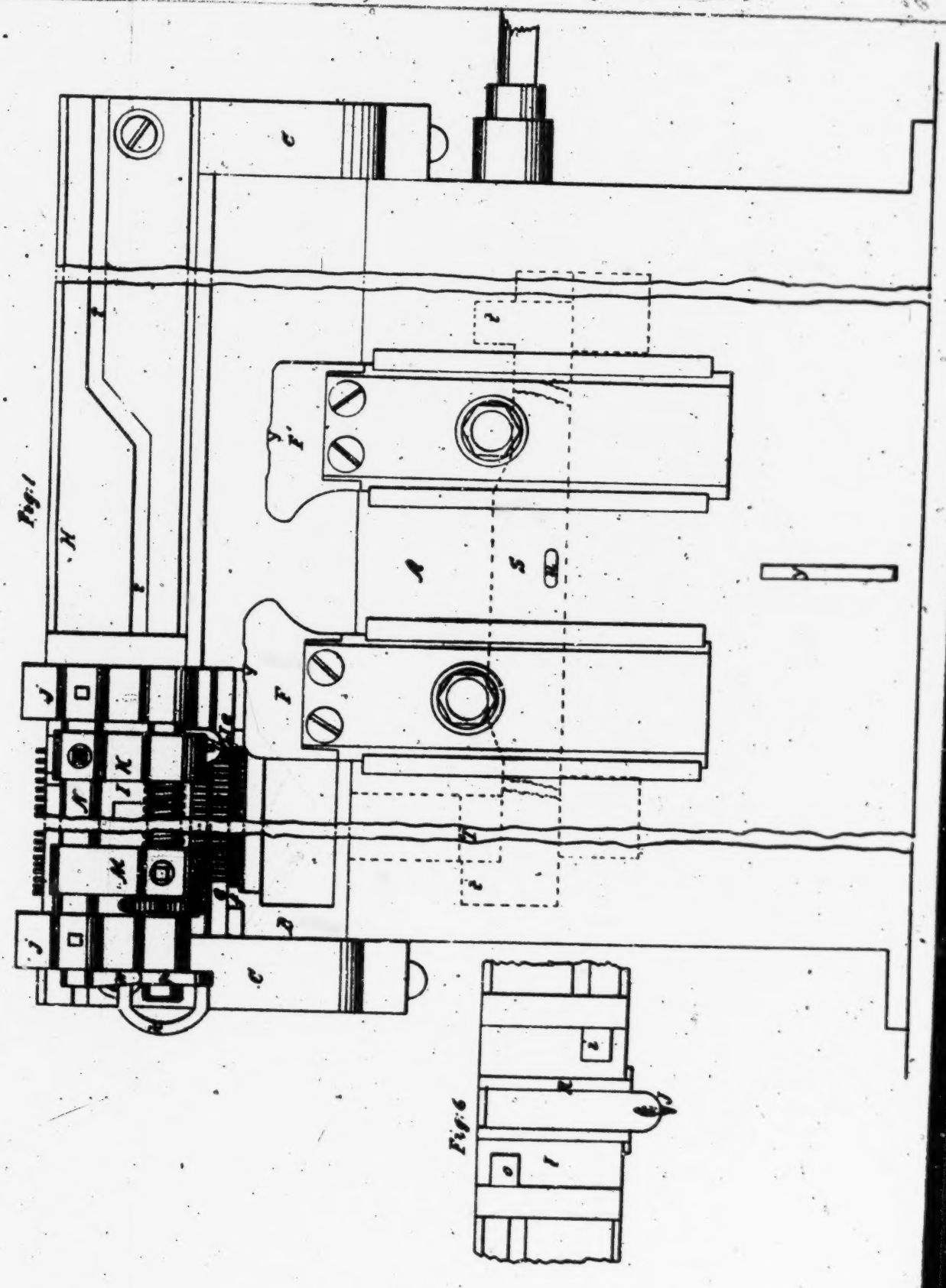
Witnesses:
CHAS. A. SIMONDET,
HARRY WRIGHT.

Sheet 1. 4 Sheets.

J. K. & E. E. Kilbourne.

Straight Knitting.

No. 19,370. Patented Feb. 16, 1858.

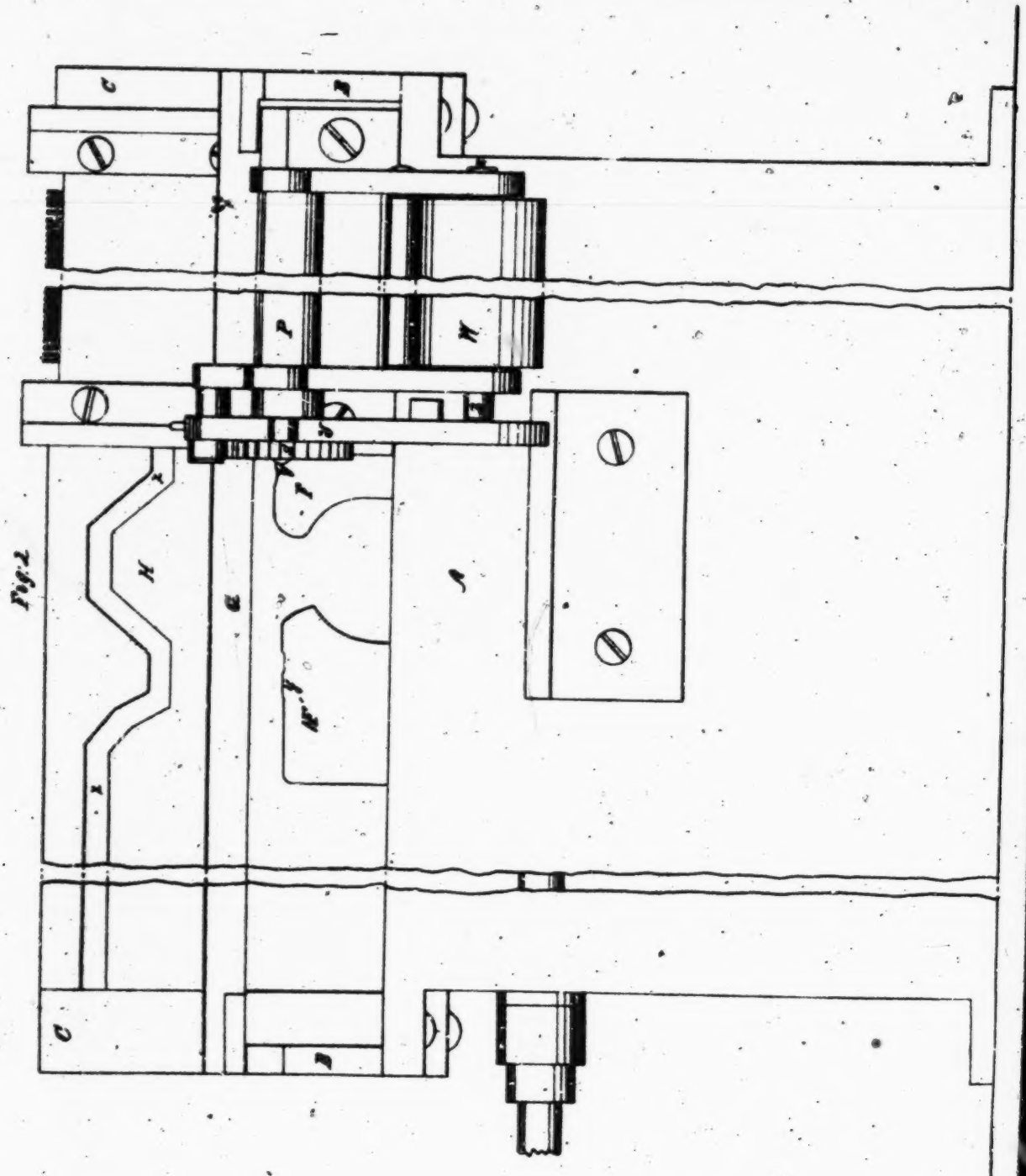


Sheet 2. 4 Sheets

J. K. & E. E. Kilbourne.

Straight Knitting.

No. 19,370. Patented Feb. 16, 1858.



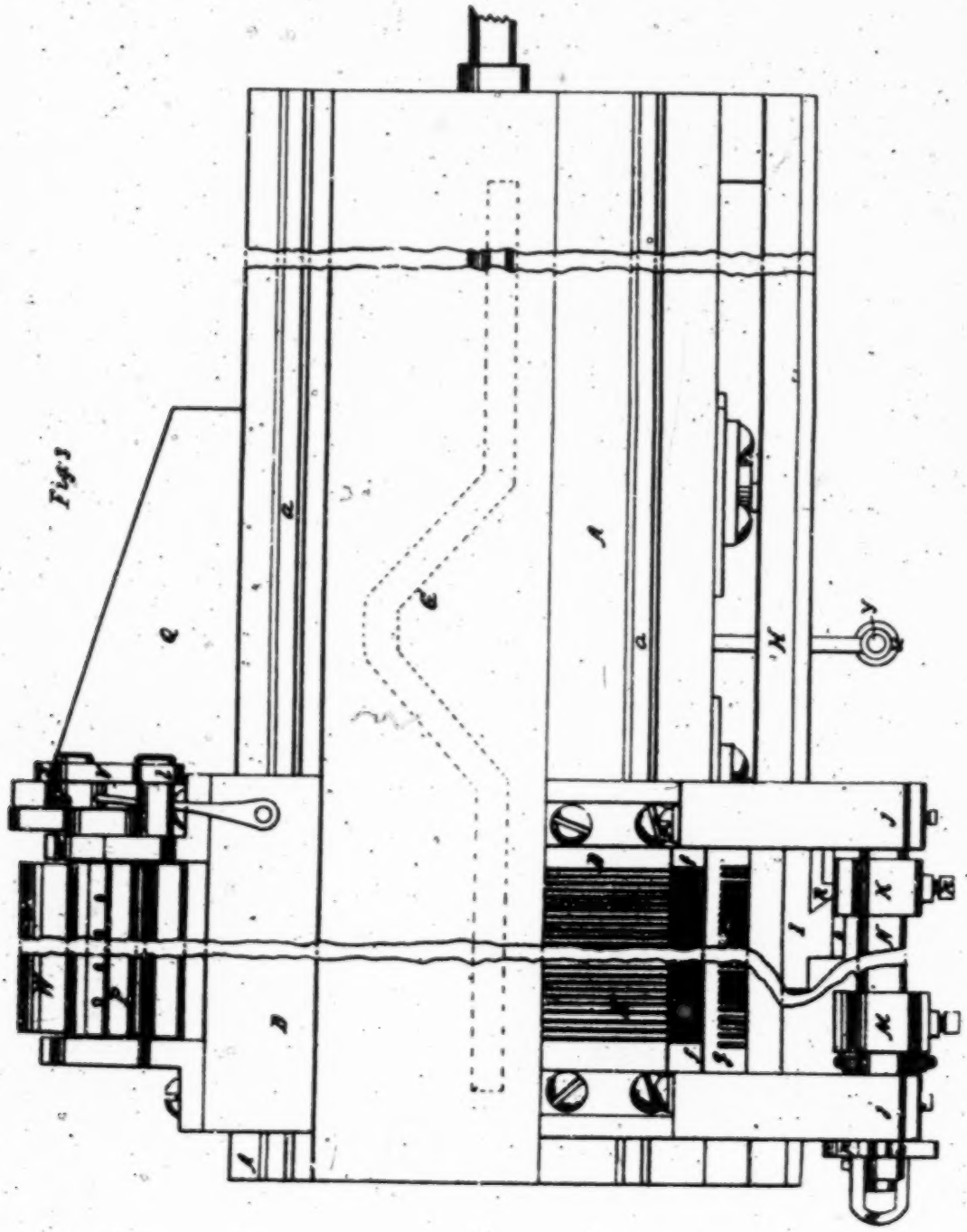
Sheet 3. 4 Sheets

J. K. & E. E. Kilbourne.

Straight Knitting.

No 19,370. Patented Feb. 16, 1858.

Fig 3



J. K. & E. E. Kilbourne.

Straight Knitting.

No. 19,370. Patented Feb. 16, 1858.

Fig. 4

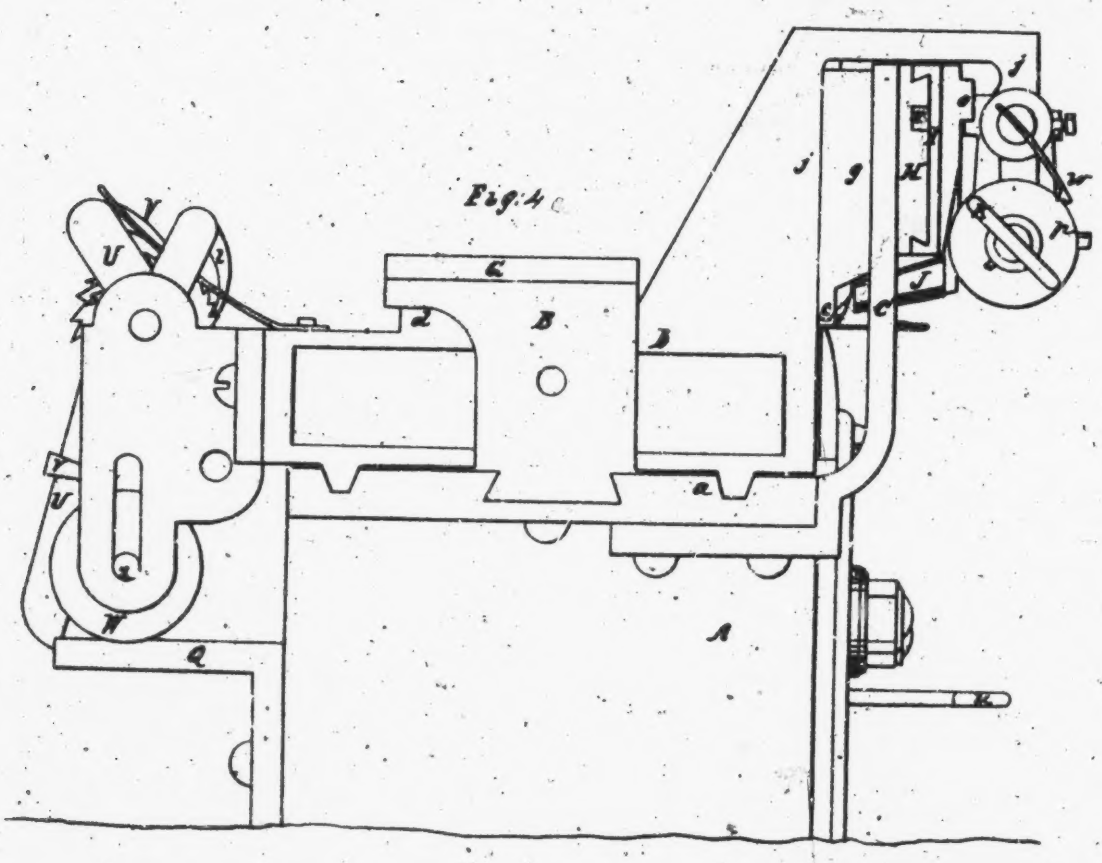
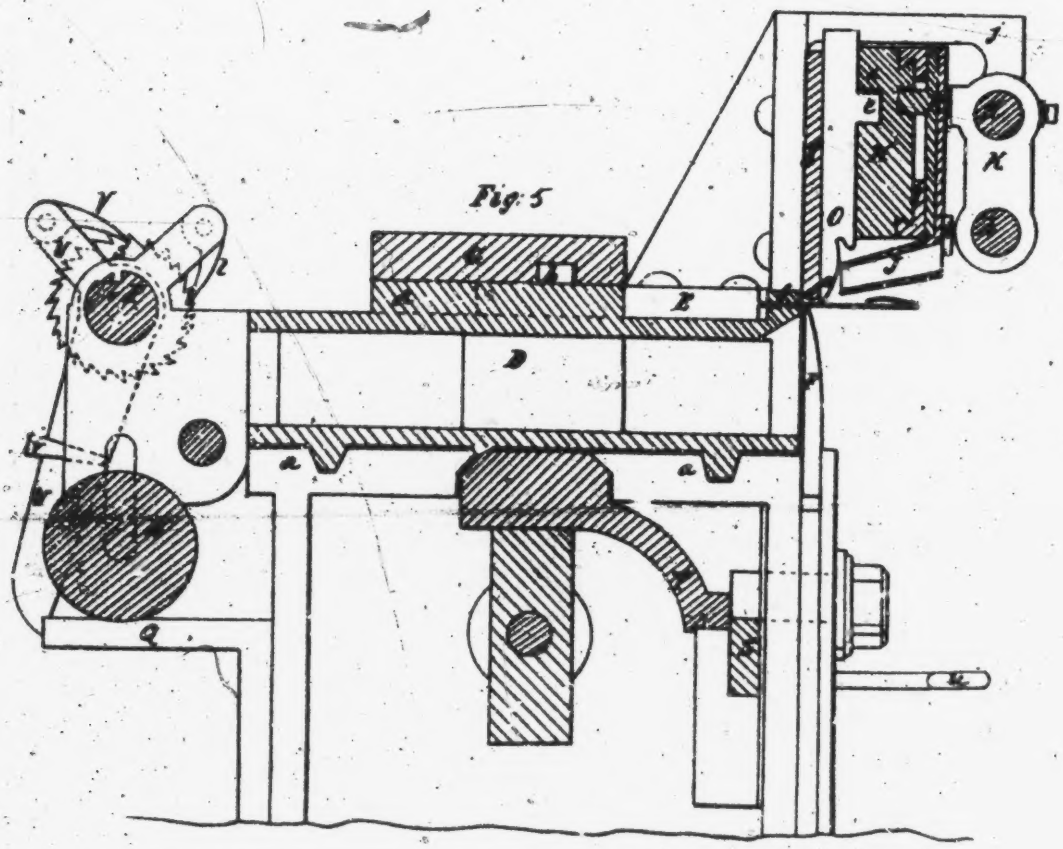


Fig. 5



UNITED STATES PATENT OFFICE.

JOSEPH K. KILBOURN AND EDWARD E. KILBOURN, OF NORFOLK, CONN.

IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. **19,370**, dated February 16, 1858.

To all whom it may concern:

Be it known that we, JOSEPH K. KILBOURN and EDWARD E. KILBOURN, of Norfolk, in the county of Litchfield and State of Connecticut, have invented certain new and useful Improvements in Knitting-Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, in which—

Figure 1 represents a front elevation of a knitting-machine with our improvements applied thereto. Fig. 2 is a back elevation of the same. Fig. 3 is a plan of the same. Fig. 4 is an end elevation of the same. Fig. 5 is a cross-section of the machine at the line *x x* of Fig. 3; and Fig. 6 is face view of the thread-guide carriage and a portion of the bar on which it traverses.

Our invention relates to that class of machines by means of which yarn is knit into fabrics; and the object of our invention is to facilitate the operation of the various acting parts of such machines, to diminish their cost, and to adapt them to the employment of self-acting apparatus for effecting the widening of the work.

The first part of our invention consists in mounting the needles, the sinkers, and their appurtenances in a reciprocating carriage, which is caused to travel to and fro upon stationary ways secured to the frame of the machine, which also has secured to it the cam-bars, by means of which the proper reciprocating movements are imparted at proper times to the needles and sinkers.

The object of the second part of our invention is to insure the uniform width of the stitches; and it consists in effecting this by causing the needles to slide in grooves whose sides converge as they approach the bottoms of the grooves which are fitted to the size of the needles.

The third part of our invention consists in combining with a reciprocating needle-carriage a second carriage, which supports the thread-guide in such manner that the latter is caused to move along with the former after the thread is fed to the whole range of needle, but is stationary while the needles and sinkers are forming the loops, although the needle-carriage is then moving.

The fourth part of our invention consists in widening the fabric by causing the thread-guide to pass down between one pair of needles and rise between another pair, this thread-guide being moved in the meantime by a motion that is independent of its ordinary reciprocating movement.

The fifth part of our invention consists in combining with a reciprocating needle-carriage under supports, which support the needles at the places where the loops are being formed and operate to close their barbs in succession.

The sixth part of our invention consists in combining with a reciprocating series of needles and sinkers stationary apparatus for imparting the necessary movements for forming the loops to different members of the series in succession, whereby the straining of the yarn in a flat knitting-loom is avoided and the apparatus for operating the needles and sinkers is concentrated at the center of the loom, and may be the same whatever number of needles is employed.

The several parts of our invention are embodied in the flat-knitting loom represented in the accompanying drawings. The various operating parts of this loom are supported by a strong rectangular bed-frame, A, which may be secured upon a table or bench at any convenient height for the operator who tends it. In the upper side of this frame there are two longitudinal V-shaped grooves, *a a*, which form ways which guide the needle carriage in traversing to and fro from one end of the frame to the other. The frame is also fitted with brackets B B C C, which sustain the cam-bars by whose action the proper movements are imparted to the needles and sinkers. The needles, as shown at Fig. 4, are of the ordinary form, and each is secured to a slide having a snug, *b*, upon it, by means of which it is moved to and fro. The sinkers, as shown at Fig. 5, are also of the ordinary form, and the shank of each one has a snug, *c*, by means of which it is moved to and fro.

The needle-carriage D is of rectangular form, and is mounted upon the bed-frame, its lower side being fitted with V-shaped feathers, which slide in the V-shaped grooves of the bed-frame. Upon the upper side of this carriage there is a block of metal, *d*, which extends its entire length, and has a series of transverse grooves in it to receive and guide the slides E of the

needles, for which it forms a bed. The needles project forward from this bed and pass through a corresponding series of transverse grooves in a bar, *f*, which extends along the front side of the carriage and forms the nosing or series of orifices, into which the needles are withdrawn to cast off the loops and from which they are protruded to receive the yarn to form a new series of loops. The grooves of this nosing have a V form, rounded at the bottom to fit the needle-wire and widening as they extend upward, so that when the needles are depressed they are caused by the forms of the grooves to place themselves at equal distances apart, and when they rise the widening of the grooves permits them to traverse freely in them, so that the uniform width of the stitches is insured without burdening the machine with an increased amount of friction.

A second block of metal, *g*, is supported by standards at the front side of the carriage. This also has a series of grooves in it, and forms a bed to receive and guide the shanks of the series of sinkers O, one of which intervenes between each two of the needles beneath. The lower edge, *e*, of this sinker-bed overlaps the nosing from which the needles protrude, and forms a bar, against the lower side of which the barbs of the needles are pressed by the action of the support F beneath to close them, so that they may pass through and cast off the loops already formed. The needle-bed *d* is surmounted by a stationary needle-cam bar, G, which is supported by the brackets B B on the main frame of the machine, and has the cam-groove in its lower face to receive the snugs *b* of the needle-slides, and thus impart motion to the needles as the carriage is moved from one end of the frame to the other. The form of the cam-groove is shown in dotted lines in Fig. 3. Immediately in front of the sinker-bed is the sinker-cam bar H, which is supported by the brackets C C, secured to the main frame. It has a cam-groove, *x*, in its hinder face to receive the snugs *c* of the sinker-shanks, and thus impart motion to the sinkers as the carriage moves to and fro.

The thread-guide J is situated in front of the sinkers, and is fitted to a carriage, I, which slides longitudinally upon ways secured to the front side of the sinker-cam bar H. The front side of this carriage has two snugs, *i* and *o*, secured to it, which are alternately struck by bumpers K and M, that are carried along by the needle-carriage D. These bumpers are hung upon a traverse-bar, N, that is supported by the overhanging extremities of the standards *j*, which secure the sinker-bed to the needle-carriage. The lower extremities of the bumpers are traversed by a screw, L, which turns in bearings attached to the standards *j*. One of the bumpers K is adjustable, so that it can be slid along the traverse-bar N and screw L, and secured in any desired position by means of a set-screw, *n*. The other bumper is also adjustable; but its position is determined by the screw L, which works in a nut, *m*, secured to the bumper M, and has a handle, *k* at one of its ends to turn it. The pitch of this screw is equal to the space between the centers of the needles, so that by turning it one or more revolutions the bumper is moved along one or more needles. The shank of the screw has a collar, *p*, upon it, which has a notch in it to receive a spring-pawl, *w*, by which the screw is secured after it has been turned to set the needle in any required position. The thread-guide J has the form of a flattened tube, whose upper and lower edges will readily enter and pass through the space between the needles. Its shank is secured to a slide, R, which slides vertically in a broad dovetailed groove formed in the face of the thread-guide carriage I. The hinder side of the slide has a snug secured to it, which is received in and operated by a cam-groove, *r*, formed in the front side of the sinker-cam bar H, so that as the thread-guide carriage is propelled to and fro by the alternate contact of its snugs with the bumpers secured to the needle-carriage the thread-carrier is depressed below and raised above the needles.

A pair of movable supports, F and F′, are supported in guides upon the front side of the main frame in such manner that they can be raised and depressed in alternate succession. The inner side of the shank or slide of each support has a snug secured to it, which passes through a slot in the bed-frame and rests upon a sliding bar, S, (represented in dotted lines in Fig. 1.) The upper edge of this sliding bar is inclined at certain parts of its length, and as the sliding bar is moved longitudinally to and fro these inclined planes pass under the snugs and raise the supports or permit them to descend out of the way of the needles. The sliding bar is moved to and fro at the proper times by means of a driver, T, secured to the needle carriage D, which driver alternately comes in contact with snugs ′, secured to the hinder face of the sliding bar, as the carriage approaches the opposite extremities of its range of motion.

The cloth-roll upon which the work is rolled up and the take-up motion are situated at the hinder side of the carriage. They may be of any construction which will perform the duties required of them. In this example the cloth-roll P is a simple cylinder having a longitudinal groove in it, in which hooks are secured, to which the end of the work is made fast. One of the journals of this cloth-roll projects beyond its box, and is fitted with a ratchet-wheel, *s*, whose teeth are operated upon by a finger, V. The latter is secured to the upper arm of a lever, U, whose lower arm hangs within the range of a stationary inclined plane, Q, secured to the back of the frame of the machine.

Below the cloth-roll there is a heavy tension-roller, W, around which the cloth is passed before it is secured to the cloth roll. The jour-

nals *z* of this tension-roll pass through slots in the hangers which support it, so that it can rise and fall and maintain a constant strain upon the work. One of its journals is prolonged beyond the hanger so as to protrude beneath a wedge-formed stop, *v*, secured to the face of the longer arm of the finger lever, so that when the tension-roller is raised by the winding up of the cloth its journal, bearing against the stop *v*, prevents the finger-lever from moving the finger V, which turns the beveled wheel. When, on the contrary, the tension-roller descends by reason of the increase in the length of the work, its journal, leaving the stop, permits the finger-lever to vibrate and move the finger V to a new tooth of the ratchet-wheel, so that the returning vibration of the finger-lever, by the action of the inclined plane over which it is drawn by the reciprocating movement of the carriage, impels the finger against the ratchet-tooth and causes it and the yarn-roll to turn.

In order to prevent the return of the yarn-roll when the finger is shifting from tooth to tooth, a spring pawl, *l*, is pivoted to the frame to act upon the ratchet-teeth.

The yarn to be knit is wound upon a tube, so that it will deliver readily, and the tube is supported upon a standard, Y, which projects from the front side of the bed-frame. Above this standard there is an eye, *u*, through which the yarn is passed, after which it is passed through the thread-guide J, and thence to the needles and sinkers.

In order to understand the operation of the machine when it is at work, let it be supposed that the carriage D is long enough to carry a sufficient number of needles and sinkers to knit the widest cloth that is required, and that the carriage is at the left-hand side of the machine, the support F being at its highest position. Let it also be supposed that the machine is knitting straight work of the full width of which it is capable. When the carriage is in this position the thread-guide is at the right-hand end of the series of needles, as represented in Fig. 1, and the yarn leads from the needle nearest the thread-guide. If, now, the carriage be moved to the right, the needles and sinkers in succession pass by the thread-guide, which, remaining stationary, feeds out the yarn to the needles as they pass. As the needles in passing ride over the support F the sinkers are caused by the action of their appropriate cam-groove to descend in succession between the needles and carry down folds of yarn, thus forming loops upon the needles, and as the descent of the sinkers is successive and but a small portion of the whole is in process of descent simultaneously, the yarn to form the loops is drawn under but these few sinkers at a time and with only a slight strain upon it or the machine. As the sinkers descend the continued progression of the carriage carries the needle-slides along the inclined portion of the needle-cam bar and causes the needles to be drawn into the orifices from which they protrude. As this operation is taking place while the needles are riding over the highest part of the support F, they are pressed up by its action against the bar *e* of the sinker-bed. The pressure thus produced closes the barbs of the needles, so that as they are drawn into the orifices they enter and pass through the series of loops of yarn previously formed, and, drawing the new set of loops with them through the previous set, cast off the latter. The withdrawal of the needles into their orifices takes place simultaneously with the ascent of the sinkers by the action of their cam-bar, so that the folds of yarn formed by the latter are rendered up to the needles as they enter their orifices. When in the motion of the carriage the set of needles has passed the thread-guide the bumper M, striking the corresponding snug, *i*, on the thread-guide carriage, causes it to move with the needle carriage, so that no more yarn is fed by the movement of the latter past the former. While the two carriages are moving together the thread-guide is caused to descend by the action of its cam-groove and to rise again as the needle-carriage approaches the extremity of its stroke, and when the needle-carriage comes to rest the thread-guide is at the left-hand end of the series of needles, ready to feed out yarn when the needles are moved from right to left. While the carriage is progressing from left to right the right-hand support is at its lowest position, as shown at Fig. 1, so as to afford no obstruction to the protrusion of the needles as their slides are again acted upon by the right-hand inclined portion of their cam-bar; but as the carriage reaches the extremity of its stroke the driver T, secured to it, striking the appropriate snug on the bar S, causes the latter to move, thus raising the right-hand support and depressing the left-hand one. The parts of the machine are now ready for the return-stroke of the needle-carriage, which is followed by a repetition of the above-described movements. In this return movement the opposite bumper K acts upon the appropriate snug *o* of the thread-guide carriage and returns the latter to its first position after the needles have all passed the thread-guide. The driver T also acts upon the opposite snug of the bar S to change the position of the supports.

In forming goods of varying widths, which is the kind of work for which this machine is specially adapted, the adjustability of the thread-guide is brought into action. In this case the narrowest part of the stuff is formed first, and the bumper M is set by turning the screw L in such manner that it will strike the appropriate snug of the needle-carriage and cause the thread-guide carriage to move with the needle-carriage when the yarn has been delivered to only a portion of the needles instead of the whole, the number so fed, and consequently the width of the work, being determined by the position of the bumper M, which is gov-

erned by the screw. By this new position of the bumper the thread-guide is sooner put in motion, and hence it is caused to descend between a pair of the needles, instead of at the end of the whole series. The needles between the descending thread-guide and the left-hand end of the carriage are thus cut off from the rest, and the width of the work is proportioned to the number of the remaining set of needles. If, now, the work is to be widened, the screw is turned to move the bumper toward the left-hand end of the needle-carriage after the thread-guide has descended and before it rises, and as the pitch of the screw in this instance is equal to the distance between the centers of the needles, each turn causes the thread-guide to rise a needle later. The thread is thus cast over an additional needle during the movement of the carriage from left to right, and the work is correspondingly widened, while as the new loop thus produced is formed of the yarn leading from the last loop of the preceding row, a selvage-edge is produced upon the tapering part of the work.

The present machine is adapted to the widening of the work at one side only; but by constructing the traverse-bar N in the form of a screw, like the lower screw, and causing it to act upon a nut in the second bumper, K, the thread-guide may be operated to widen the work at either side at pleasure. If, on the other hand, the lower screw have at one end a right-handed screw-thread and at the other end a left-handed screw-thread, each thread operating on a nut secured to one of the bumpers, the widening would be effected at the opposite edges of the work equally in opposite directions by the turning of the one screw, L. Narrowing the work may be effected by turning the screw in the reverse direction to that for widening. The work formed is drawn beneath the upper side of the carriage, is passed around the tension-roller, and is applied to the take-up roller P, upon which it is wound as it is formed by the operation of the take-up motion.

By the system we have devised of supporting the needles and sinkers upon a traversing carriage the whole of the work of knitting is performed near the center of the machine, and the cam-bars and supports, which are subjected to the greatest strains, may all be secured firmly to the bed-frame, while at the same time the positions of the needle and sinker cam bars relatively to their needles and sinkers tend to bear the latter downward and prevent any tendency in the needle-carriage to rise from its ways. An examination of the supports shows that their upper edges deviate from a straight line, and these deviations are important. When the needles in their movements first reach each support they move over the lowest portion of the latter, so that the needles are then permitted to rest in the lowest portions of the orifices of the needle-bed. As these orifices are contracted at their bottoms so as to fit the needles, the latter, in being depressed to the bottoms of the grooves by the forcing down of the folds of yarn by the sinkers, are caused to arrange themselves at equal distances apart, whereby the uniformity in the sizes of the folds, and consequently of the loops, is insured. The elevation of the edge of the support at y above its lowest level is an advantage, as the raising of the needles at this point permits the slope of the sinker-cam groove to be made less abrupt than it would otherwise have to be, and thus enables the machine to be operated with less friction. The elevation of the highest portion of the support is a matter of necessity, as it raises the needles in succession and causes their barbs to press against the bar above, by which they are closed.

In the foregoing description the take-up mechanism is described as moving along with the needles and sinkers. This combination permits the employment of a very simple take-up mechanism and obviates the difficulty that would arise from the use of a reciprocating series of needles and sinkers with stationary take-up mechanism, as in the latter case some means would have to be devised to give back and take up cloth as the needles and sinkers move to and fro.

It will be evident to the skillful engineer that portions of our machine may be modified without affecting the principle of our invention, and we contemplate so to modify the various parts of our machine as circumstances may render expedient. Thus, for example, the take-up motion we have described may be varied by substituting a pair of nipping and drawing rollers in place of the single cloth-roll, in which case the fabric will be delivered from the pair of rollers in a flat sheet. Motion may also be imparted to the feed-carriage by a segment and rack, or by a crank, or by an eccentric, or in any manner that may be convenient.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. Combining the needles and sinkers with a reciprocating carriage operating substantially as herein set forth.

2. The adjustment of the position of the needles at the time the sinkers are forming the folds of yarn by means of grooves in the nosing, whose sides converge so as to insure the uniform width of the stitches.

3. The combination of a reciprocating series of needles with a reciprocating thread-guide, operating, substantially as herein set forth, so as to move at times with the needles and to remain stationary at other times when the needles are moving.

4. The varying of the width of the fabric by causing the thread guide to pass down between one pair of needles and to rise between another pair by mechanism operating substantially as herein set forth, thus producing a selvage-edge where widening is effected.

5. The combination of under supports, operating substantially as herein set forth, with a reciprocating series of needles, so as to sup-

port the needles and effect the closing of their barbs.

6. Combining with a reciprocating series of needles and sinkers cam-bars or their equivalents in such manner as to impart the necessary movements for forming the loops to the several members of the series in succession, substantially as herein set forth.

7. Combining a reciprocating series of needles and sinkers with reciprocating mechanism for taking up the work as it is formed, substantially as herein set forth.

In testimony whereof we have hereunto subscribed our names.

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KNITTING MACHINE.

APPLICATION FILED NOV. 16, 1912.

1,134,749.

Patented Apr. 6, 1915.

6 SHEETS—SHEET 1.

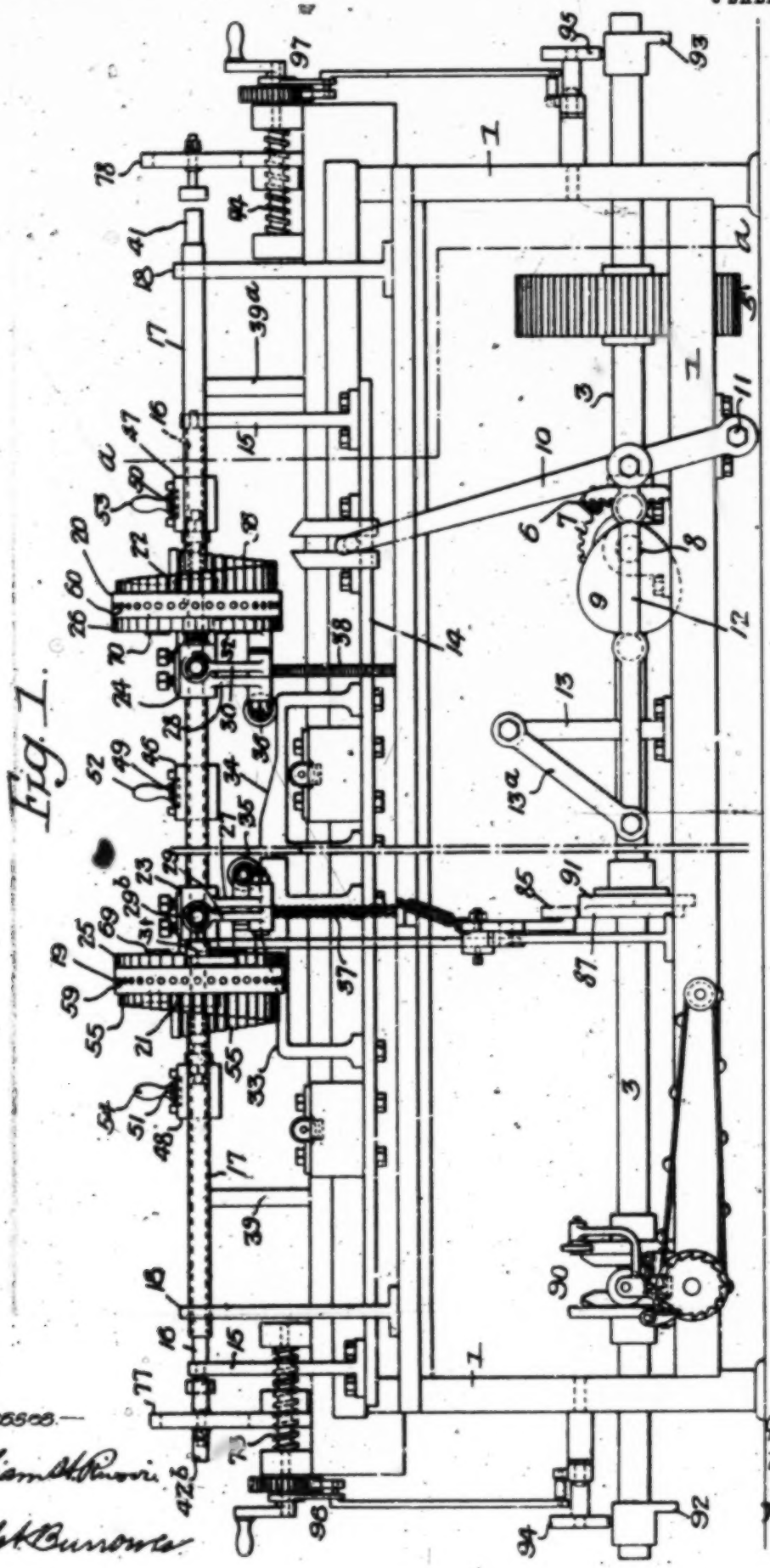

Fig. 1.

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KNITTING MACHINE.

APPLICATION FILED NOV. 16, 1912.

1,134,749.

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6 SHEETS—SHEET 2.

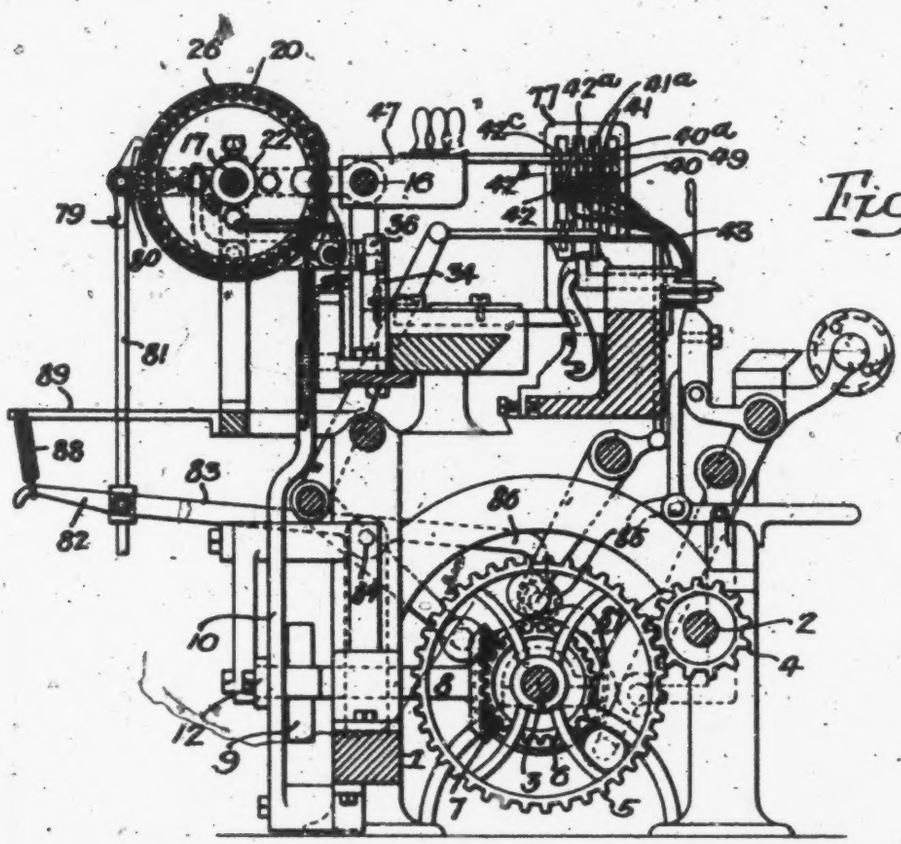
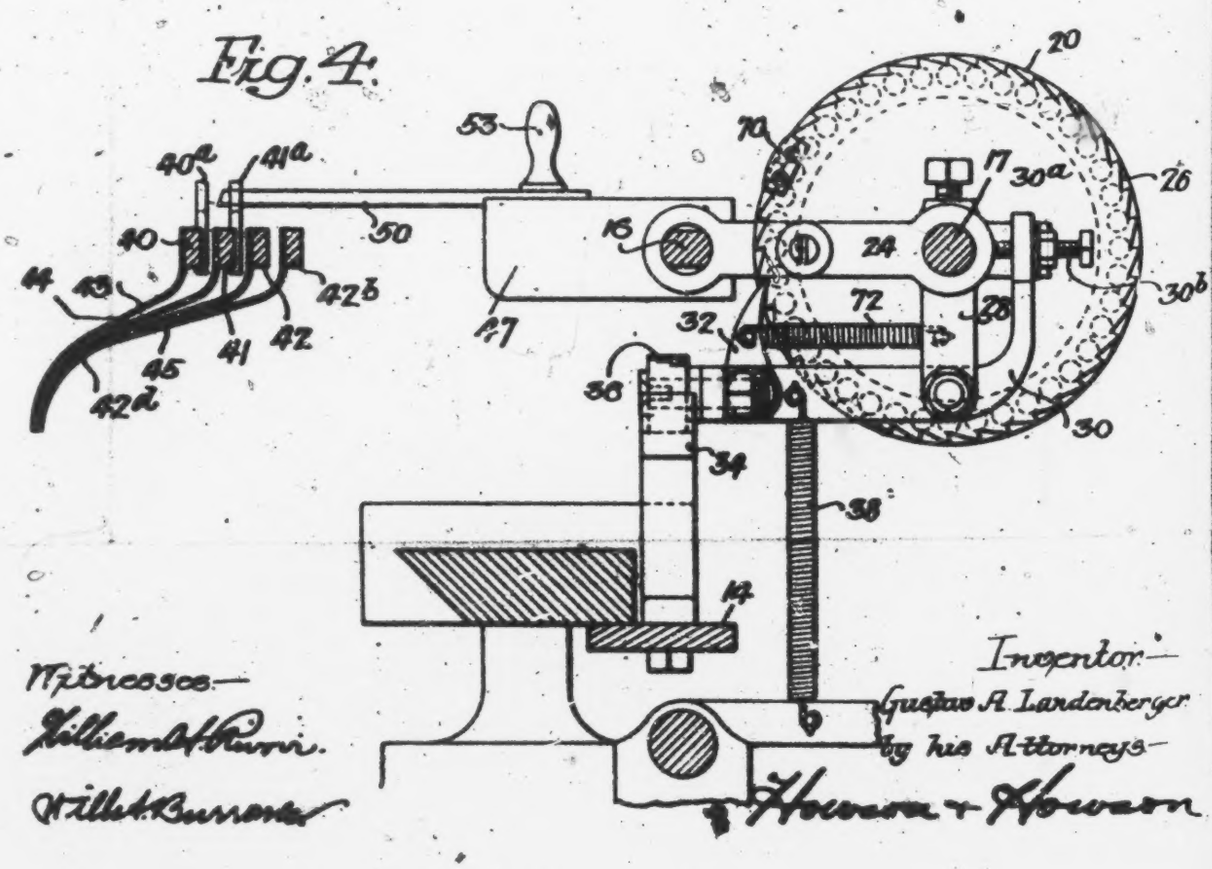


Fig. 2.

Fig. 4.



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6 SHEETS—SHEET 3.

Fig. 3.

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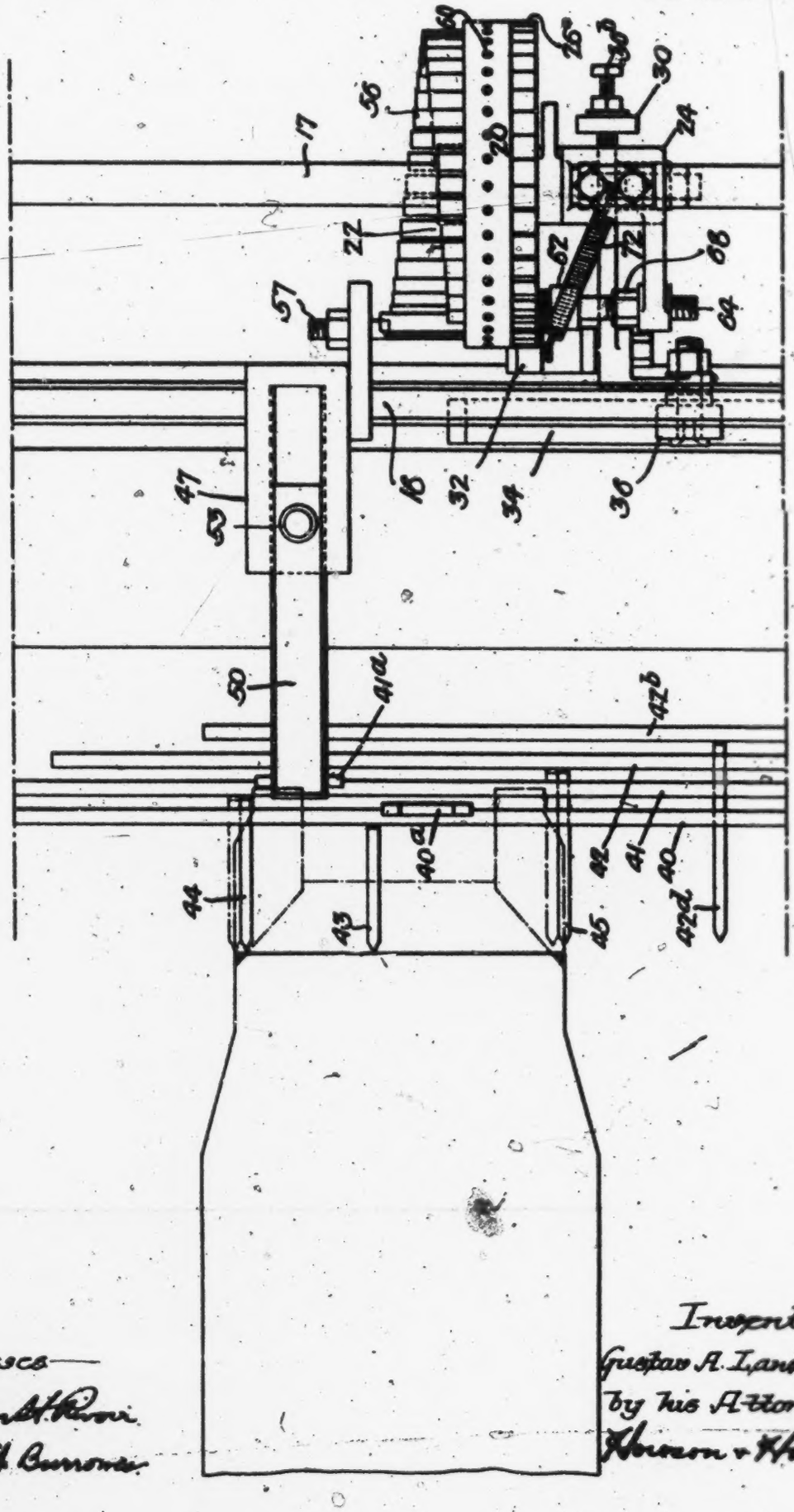
6 SHEETS—SHEET 4.

Fig. 5.



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6 SHEETS—SHEET 6.

Fig. 6.

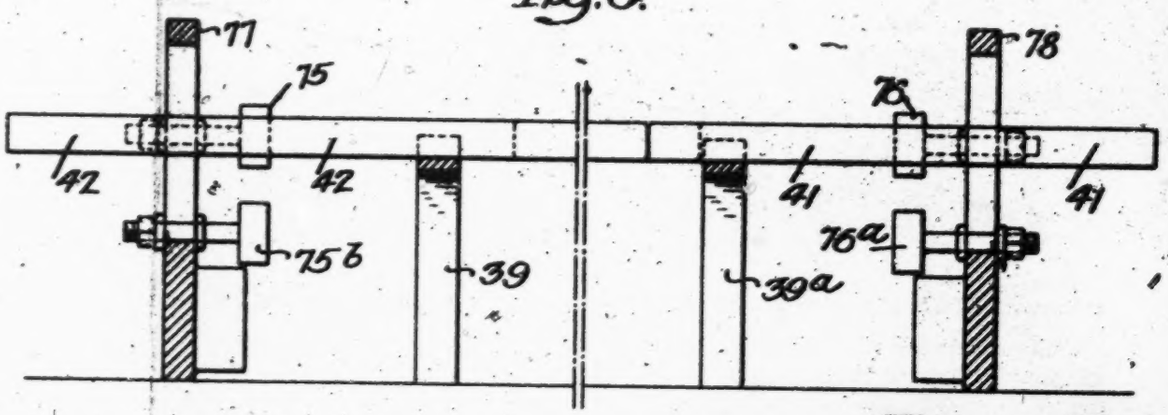


Fig. 13.

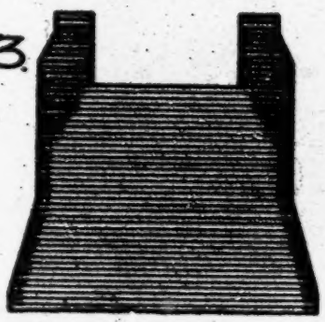


Fig. 7.

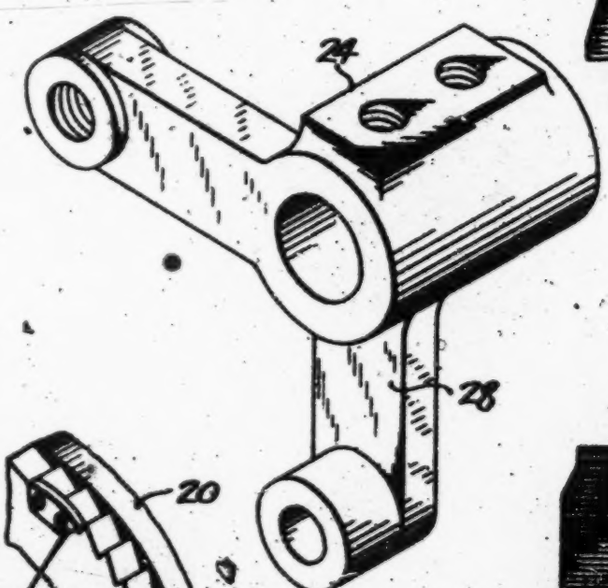


Fig. 14.

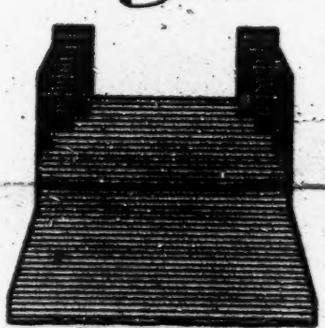
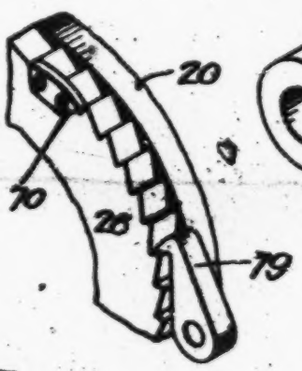


Fig. 12.



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522

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Patented Apr. 6, 1915.

6 SHEETS—SHEET 6.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

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UNITED STATES PATENT OFFICE.

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KNITTING-MACHINE.

1,134,749. Specification of Letters Patent. Patented Apr. 6, 1915.

Application filed November 16, 1912. Serial No. 731,880.

To all whom it may concern:

Be it known that I, GUSTAV A. LANDENBERGER, a subject of the Emperor of Austria-Hungary, having declared my intentions of becoming a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Knitting-Machines, of which the following is a specification.

My invention relates to knitting and consists of yarn-feed controlling mechanism for knitting machines, being particularly serviceable for controlling the movement of the yarn carriers which feed extra or reinforcing threads to certain of the needles, such for example as to the needles which form heel portions of stockings on straight knitting frames such as the "Cotton" type which have a plurality of banks of needles; each bank being capable of knitting a separate stocking leg or other fabric.

Heretofore in the manufacture of full fashioned stockings on straight knitting machines of the above described type, the splicing or reinforcing threads for the heel portion were generally inserted in such a manner that the line of intersection between the reinforced knitted web, constituting the heel portion, and the ordinary knitted web, constituting the main portion of the stocking, ran in a line substantially at right angles to the wales of the web. This abrupt change caused a very unsightly portion in the stocking which tended to detract from the graceful lines caused by the shaping of the leg portions and the ankle portion.

One object of my invention is to provide a knitting machine with mechanism which will control the feeding of the splicing or reinforcing threads to the needles in such a manner that the line of intersection between the reinforced heel portion and the ordinary web constituting the leg portion will run at an incline to and gracefully intersect and merge into the wales of the leg portion.

Another object is to form a reinforced selvage along each edge of the fabric, said selvage conforming to the fashioning of the fabric and merging into a reinforced heel portion; the lines of intersection between the heel portion and the selvage and the web constituting the main leg section running at an incline to the wales of the fabric.

A still further object is to make the mechanism of my invention of a durable and simple construction which is easy of operation and which may be made and maintained at a very low cost.

These and other objects which will be hereinafter described I attain in the following manner, reference being had to the accompanying drawings in which:

Figure 1, is a rear elevation of sufficient of a straight knitting machine of the above described type to illustrate my invention; Fig. 2, is a sectional end view taken on the line *a*—*a* Fig. 1; Fig. 3, is a plan view of the mechanism shown in Fig. 1; two banks of needles being shown; Fig. 4, is an enlarged sectional end view of certain of the mechanism comprising my invention; Fig. 5, is a plan view of Fig. 4 showing a diagrammatic representation of a stocking leg made with the aid of my invention; Fig. 6, is a fragmentary sectional elevation showing different positions of certain of the elements; Fig. 7, is a detail perspective view of one of the supporting members forming a part of my invention; Fig. 8, is a diagrammatic representation in a flat state of a stocking leg capable of being knitted by the aid of my invention; Fig. 9, is another diagrammatic representation in a flat state of a stocking capable of being made by the use of my invention, and which shows a reinforced selvage adjacent the seaming edges, said selvage merging into a reinforced heel section in which the line of intersection between the reinforced heel portion and the plain web runs at an incline to the wales of the fabric; Fig. 10, shows a stocking leg completed from the fabric shown in Fig. 8 and having a foot portion knitted thereto; Fig. 11, shows a stocking leg completed from the fabric as shown in Fig. 9 and having a foot portion knitted thereto; Fig. 12, is a fragmentary perspective view showing a hook pawl in engagement with a ratchet forming part of the operating mechanism of my invention; and Figs. 13 and 14, are views of modified forms of heel reinforcements, capable of being made with my invention.

Referring to the drawings, 1 is the main frame of a straight knitting machine, of the above described type, forming a support for a main power shaft 2 and a cam shaft 3 having intermeshing gear wheels 4 and 5 respectively. The cam shaft 3 is provided with a beveled gear 6 which meshes with a gear 7 on the shaft 8; the latter being known as the "Coulier" shaft and having keyed thereon a cam 9. A reciprocable lever 10 is

pivoted to the frame 1 at 11 and in turn has pivoted thereto a link 12 pivotally swung from a stanchion 13 by means of an arm-link 13ª. Anti-friction rollers are journaled within the link 12 in such a manner that the cam 9 will operate therewith to actuate the said link 12 to reciprocate the lever 10 as is obvious from the construction shown in Fig. 1 of the drawing.

The frame 1 forms a support for the cock-box bar 14 and the lever 10 is so arranged as to engage and impart a reciprocating movement to the said cock-box bar. Supports 15 are rigidly fixed to the cock-box bar 14 and in turn form a support for a friction shaft 16; the latter being rigidly fixed in the said supports 15. The elements above mentioned are of a construction well known in the art. A shaft 17, which will be hereinafter termed the "pattern" shaft, is rigidly mounted on supports 18; the latter being mounted on frame 1. The shaft 17 forms a journal for two pattern drums 19 and 20 which are rotatable thereon but prevented from having any longitudinal movement by collars 21 and 22 and two-armed castings 23 and 24 respectively. The drums 19 and 20 are provided with ratchet wheels 25 and 26 respectively. The arms 27 and 28 of the castings 23 and 24 form pivotal supports for double ended levers 29 and 30; the latter having pawls 31 and 32 respectively pivotally mounted thereon; the pawls 31 and 32 being adapted to engage and being wide enough to project beyond the outer edge of the ratchet wheels 25 and 26, respectively.

The cock-box bar 14 forms a support for cams 33 and 34 and imparts a reciprocating movement thereto. The levers 29 and 30 have antifriction rollers 35 and 36 respectively which are so placed as to be engaged during the reciprocation of the cock-box bar 14 by the respective cams 33 and 34 to lift the levers 29 and 30 to cause the pawls 31 and 32 to rack with the respective ratchet wheels and intermittently move the drums 19 and 20 on their axes. The pawl supporting ends of the levers 29 and 30 are normally held in their lowest positions by means of tension springs 37 and 38 which are connected to the respective levers 29 and 30 and to a fixed portion of the machine. The ends 29ª and 30ª of the levers 29 and 30 are provided with adjusting or set screws 29ª and 30ª; the ends of the said set screws being adapted to be moved toward or from the respective castings 23 and 24 so as to be able to adjust the movement of the said levers 29 and 30 with respect to the cams and to the ratchet wheels 25 and 26.

The carrier-rod stands 39 and 39ª are rigidly attached to the frame 1 and in the present instance form a slidable support for four carrier rods 40, 41, 42 and 42ª. The carrier rod 40 is the main carrier rod and has attached thereto a plurality of yarn guides or thread carriers 43, each of said carriers 43 being adapted to feed a thread to the needles of one section or bank of the machine in a multiple section machine such as herein described and illustrated to produce the leg portions of the stockings. The carrier rod 41 has a plurality of yarn guides or thread carriers 44; each being adapted to carry and feed an extra splicing or reinforcing thread to certain of the needles also fed by the carriers 43 to produce one-half of the reinforced heel portion of a stocking leg knitted on one section or bank of the needles. The carrier rod 42 has a plurality of yarn guides or thread carriers 45, and each of said carriers is adapted to carry and feed an extra splicing or reinforcing thread to certain needles also fed by the carriers 43 of respective banks of needles to produce the other half of the reinforced heel portions of the respective stocking legs as clearly shown in the several views of drawing.

The friction shaft 16 as illustrated in the accompanying drawings forms a support for three friction boxes 46, 47 and 48. These friction boxes may be of any well known construction having a friction producing substance such as leather or the like—always in contact with the friction shaft so that each friction box will slide over the friction shaft if sufficient force is applied thereto but ordinarily will move with the friction shaft. The friction boxes 46, 47 and 48 have slides 49, 50 and 51 respectively which may be moved by means of respective handles 52, 53 and 54 in a direction toward the carrier bars. The slide 49 when extended is adapted to pass between the prongs of a fork 40ª fixed to the bar 40. The slide 50 when extended is adapted to pass between the prongs of a fork 41ª fixed to the bar 41. In like manner the slide 51 when extended is adapted to pass between the prongs of a fork 42ª fixed to the bar 42 as clearly shown in Fig. 3. The carrier rod 42ª is only used in finishing the heel portion and is provided with a fork 42ª for a purpose hereinafter described. The frictional contact between each friction box and the friction shaft is such that the movement of the friction shaft will be imparted through the medium of the friction boxes to respective thread carrier bars unless the movement of the latter is obstructed in any manner. However, if the thread carrier bars 40, 41 and 42 are obstructed in their movement in either direction before the friction shaft has finished its movement in corresponding directions the latter will slip through the several friction boxes which necessarily stop when their respective thread-carrier bars are stopped and when their slides are in engagement with respective forks. Thus it will be seen that if mecha-

nism having a portion of varying contour is positioned so as to limit to different extents the movements of the several thread carrier bars, the thread carriers will be moved correspondingly to different extents and thereby feed yarn to different and variable numbers of needles in each bank or set of needles. To accomplish this end I set and fix within each pattern drum 19 and 20 by lock screws 59 and 60 respectively a series of pins 55 and 56 of varying length and mount on the friction boxes 47 and 48 adjustable abutment pins 57 and 58; the pin 57 being adapted to contact with the pins on the pattern drum 20, while the pin 58 is adapted to contact with the pins on the pattern drum 19. As shown in the accompanying drawings the pins are disposed in an annular figure and a movement of one tooth of each ratchet is sufficient to move successive pins into the path of their respective abutment pins on the friction boxes. The pins on the pattern drums 19 and 20 are prevented from working loose or varying their projected lengths by means of the lock screws 59 and 60 respectively.

In order to prevent the over running of the pattern drums due to their inertia caused by the movement of the respective pawls engaging the ratchet wheels thereon, I provide brakes 61 and 62 which in the present instance comprise threaded stems 63 and 64 having receptacles 65 and 66 adjacent one end; said receptacles having friction producing material forming shoes mounted therein and projecting therefrom so as to engage a surface of the pattern drums. The stems 63 and 64 may be adjusted by means of a screw-driver or other means so as to move the friction shoe toward or from the surface of the pattern drum. After being adjusted the brakes may be locked by means of nuts 67 and 68. These brakes are also so positioned as to counteract any lateral movement of the pattern drums which would otherwise be caused when the abutment pins contact with their respective pattern pins.

The ratchet teeth, as shown in the drawings adjacent respective short pattern pins of each pattern drum, are prevented from being engaged by the pawls 31 and 32 by dwell plates 69 and 70, which are screwed to the ribs of the ratchets and beyond the periphery of the ratchet teeth. However, these dwell plates may be moved to project beyond any of the teeth if it is so desired for any purpose, and their function will be described more fully in the operation of the machine. Tension springs 71 and 72 are connected between respective pawls 31 and 32 and tend to hold the said pawls in engagement with their respective ratchet teeth or with the dwell plates 69 and 70, so that for every upward movement of the levers 29 and 30 the ratchet wheels and pattern drums will be intermittently moved to the extent of one ratchet tooth except when the plates 69 and 70 pass underneath the pawls at which time the movement of the levers 29 and 30 will not move the pattern drums.

Fashioning screws 73 and 74 of the usual construction employed in straight knitting machines, are mounted adjacent opposite ends of the machine and are automatically operated at predetermined periods, by the usual mechanism, for moving the carrier rod stops 75, 75ª, 75ᵇ, 76, 76ª and 76ᵇ toward or from the adjacent ends of the respective carrier rods. As they are shown on the drawing; the stops 75 and 76 are adapted to arrest the movement of the carrier bar 40 in opposite directions; the stop 76ª is adapted to arrest the movement of the bar 41 and the stop 75ᵇ is adapted to arrest the movement of the bar 42; the stops 76ª and 75ᵇ only acting when the machine is knitting the heel portion as will be more fully described hereinafter. As shown in Fig. 6, the standard 77 which supports the stops 75, 75ª and 75ᵇ, and the standard 78 which supports the stops 76, 76ª and 76ᵇ are each slotted so that the stops 75ª, 75ᵇ, 76ª and 76ᵇ may be moved out of the way of the carrier rods 41 and 42 to permit the latter being slid through the slots. By this means the respective thread carriers are kept out of the boundary lines of the needle banks when the machine is knitting the plain or leg portion of the stocking and do not interfere with the movement of the thread carriers 43 during the knitting of the said plain leg portions.

In order to produce stocking legs having reinforced heel portions as shown in Fig. 8 the pattern drums are mounted on the shaft as clearly shown in Figs. 1 and 3 so that the free ends of the pattern pins on the drum 19 extend toward the stop support 77 and the free ends of the pins on the drum 20 extend toward the stop support 78. The abutment pins on the friction boxes 47 and 48 are so disposed as to contact with the ends of the pattern pins on respective pattern drums so that as the friction shaft moves the friction boxes 47 and 48 in one direction, the pin 58 on the friction box 48 will abut the end of a pattern pin on the drum 19, while the abutment pin 57 on the friction box 47 will move away from the ends of its coöperating pattern pin on the drum 20. On the opposite movement of the friction shaft however, the abutment pin 57 on the friction box 47 will move into contact with a pin of its pattern drum while the abutment pin 58 on the friction box 48 will move away from its cooperating pin on the pattern drum 19.

For purposes of producing a leg section as shown in Figs. 9 and 11 where the same is provided with a reinforced selvaged edge which continues from the top of the stocking throughout the entire length and merges

into the reinforced heel portions in a manner as before stated, I provide an auxiliary means for rotating the drums 19 and 20 so that the reinforced selvaged edge may also be produced during the fashioning of the leg.

When the fashioning is taking place it is desirable that the reinforcing yarn adjacent the edges of the fabric shall follow the angle of the fashioned edge as shown in Fig. 13. To accomplish this end I throw the pawls 31 and 32 out of action and rotate the drums by ratchet hooks 79 respectively mounted on arms 80 so as to actuate the ratchets 25 and 26 of said drums once for each revolution of the cam shaft 3. Each arm 80 is pivotally connected by a rod 81 to the end 82 of a double-ended lever 83 pivotally supported to the frame 1 at 84.

In order to limit reinforced selvage edges as shown in Fig. 13, the pins on the pattern drums are placed so that those which control the reinforcing yarn at the fashioned portions have a step formation, that is, they are arranged in a series of sets of which those of each set are all of the same length but different in length from those of the other sets. This particular arrangement of pins will result in the production of the same number of courses of reinforcing yarn as there are pins in a set before there is a change in the amount of inward movement of the reinforcing yarn carriage and will produce neat and durable selvage edges at the fashioned portions of the stocking. It will be understood however that other arrangements or movements of the pattern pins may be employed to produce different forms of reinforced selvage edges without departing from my invention.

When the machine is not operating to form the fashioning, an antifriction wheel 85 on the end 86 of the double-ended lever 83 is held in contact with a disk 87 on the cam shaft 3 by a tension spring 88 having one end attached to an extension 89 of the frame 1 of the machine, and the other end attached to the end 82 of the lever, so that a rotation of the shaft 3 will not impart movement to the hook 79. As the cam shaft 3 receives a slidable or longitudinal movement from the automatically controlled mechanism 90, of any well known type, in order to form the fashioning of the leg portion in the usual manner, I provide a cam 91 which, when the said shaft 3 is longitudinally moved will slide under and come in contact with the anti-friction wheel 85 (see Figs. 1 and 2). As the shaft 3 is rotated a reciprocating movement will be imparted to the arm 80 and the ratchet hooks 79 will rack with the ratchet 25 thereby moving the drum 19 during the time when a fashioning is taking place for the reason that the said longitudinal movement of the shaft 3 also slides cams 92 and 93 into a path with antifriction wheels 94 and 95 respectively. Well known ratchet mechanism 96 and 97 actuates the fashioning screws 73 and 74 to move the carrier-rod stop supports 75 and 76 toward each other. When the fashioning, as just stated is completed, the shaft 3 will be automatically moved in the opposite direction and the cams 92 and 93 will be moved away from their respective antifriction wheels 85, 94 and 95, thereby stopping the movement of the hook 79 and fashioning screws 73 and 74.

As the mechanism for effecting the knitting forms no part of my invention I have not illustrated or described the same in detail but have shown it in a general way on the drawing which will enable any one to follow out the purpose and construction of said invention.

When the machine is in a position to begin the knitting of stocking legs as shown in Fig. 8, each reinforcing thread carrier 44 and 45 is in a position outside the boundary of its respective needle bank (see Fig. 3 in dot-and-dash lines); the stops 76[a] and 75[b] having been moved out of the way to allow the carrier rods 41 and 42 to project through respective slots in the standards 78 and 77 (see Fig. 6). Also, the friction-box slides 50 and 51 are withdrawn from their respective forks on the carrier rods 41 and 42, and each main thread carrier 43 is adjacent one end of its respective bank of needles; the friction-box slide 49 being in engagement with the fork on the carrier rod 40. Also, when the stockings are being started the thread carriers 43[a] on carrier rods 42[a] are also out of action so as not to interfere with the main thread carriers 43 and the end of the bar 42[a] projects through a slot in the stop support 77.

The operation is as follows: Motion is imparted to the cam 9 through the medium of the main power shaft 2, gears 6 and 7, and Coulier shaft 8, and the said movement of the cam causes a reciprocating movement to be transmitted to the cock-box bar 14. As the friction shaft 16 and cams 33 and 34 are attached to the cock-box bar 14 they receive a reciprocating motion similar thereto. The movement of the friction shaft imparts motion to the carrier rod 40 through the medium of the friction box 46 and the thread carriers 43 are thereby reciprocated and feed yarn to all the needles. The limit of movement of the thread carriers 43 is determined by the distance between the carrier rod stops 75 and 76, as the rod 40 is so adapted as to strike each of the said carrier stops in its reciprocating movement. As the movement of the friction shaft is greater than the distance of travel of the carrier rod 40 as determined by the said stops 75 and 76 the friction box will move the said rod

40 until the latter strikes a stop 75 or 76 and then the friction shaft slides through the friction box 46 the difference in the amount of travel of the rod and the friction shaft; this same being true in both directions of the movement of the friction shaft and being rendered necessary as will be hereinafter described during the narrowing of the main web and when the stops 75 are brought closer together. After each thread carrier 43 has fed a length of yarn to the needles of its respective bank the usual knitting operation takes place to form the thread into loops. This operation of the thread carriers 43 takes place throughout the full width of the web which is knitted from points X—X to X—Y as clearly shown in the drawing in Figs. 3 and 8. During the knitting of this portion of the webs the selvage or garter top of the stocking is produced by transferring the first course of loops on to a subsequent course in the usual manner.

The machine illustrated in the drawing is provided with a well known mechanism for gradually moving the stop supporting standards 77 and 78 toward each other as above mentioned and after the stocking webs have been knitted to the point Y—Y. This moving together of the stop supporting standards 77 and 78 with the stops 75, 75ª, 75ᵇ, 76, 76ª and 76ᵇ causes the stops 75 and 76 to gradually decrease the limit of movement of the carrier rod 40 and as the thread carriers 43 receive a movement equal to the movement of the carrier rod 40 they will feed yarn to a less number of needles for each movement of said rod in each direction. Therefore, as there are a smaller number of needles knitting for each reciprocation of the rod 40 the fabric will gradually be narrowed from each edge until the movement of the stops 75 and 76 toward each other is stopped by any well known mechanism (one form of which is shown in Fig. 3 and acts to automatically move the cam shaft 3); such a narrowing of the fabric being shown in Figs. 3 and 8 from Y—Y to Z—Z. This narrowing or fashioning is well known in the art and is caused to produce a smaller diameter of the stocking leg, when seamed, so as to provide for the difference of diameter between the calf and the ankle portions thereof. After the said movement of the carrier rod stops has discontinued, the thread guides 43 will continue to feed threads to a number of needles equal to the width of the fabric at this point or the movement of the said carrier rod 40 at this point until the fabrics have been knitted to Z', Z'.

After the fabrics have been knitted to the points Z', Z' the slide 50 is moved into engagement with the fork 41ª on the carrier rod 41 and the slide 51 is brought into engagement with the fork 42ª on the carrier rod 42. Also the pawls 31 and 32 are placed in mesh with the ratchets 25 and 26 and the drums 19 and 20 are so arranged that the longest pins 55 and 56 thereon are in alinement with respective abutment pins 58 and 57. After the carrier rods 41 and 42 have been moved so that their respective forks 41ª and 42ª are engaged by the slides 50 and 51 the stops 75ª and 75ª are raised into position to be abutted by the ends of the said rods 41 and 42. Also, the positioning of the several parts is such that a thread carrier 44 and a thread carrier 45 will be adjacent respective edges 98 and 99 of the fabric at the points Z', Z'. A continued movement of the machine will then cause the cams 33 and 34 to raise the rollers 35 and 36 and through the medium of the levers 29 and 30 cause the pawls 31 and 32 to rack the ratchet wheels on the respective drums 19 and 20. At the same time the slides 49, 50 and 51 will impart motion to the respective thread carriers 43, 44 and 45 on the bars 40, 41 and 42 through the medium of the friction boxes 46, 47 and 48 on the friction shaft 16. Therefore, as the bar 40 is allowed to move the full movement as prescribed by the distance between the stops 75 and 76 the thread carriers 43 will continue to serve yarn to all the needles, which have previously been working during the knitting of the fabric from the points Z, Z to the points Z', Z' and thereby continue to knit a fabric of similar width. However, the thread carriers 44 and 45, during their movements inwardly from the edges of the fabrics due to the reciprocation of the friction shaft will be prevented from feeding yarn for the full width of the fabric at this point by the abutment pins 58 and 57 coming in contact with the said long pins 55 and 56, as the movement of the thread carriers 44 and 45 is dependent upon the movement of the friction boxes 48 and 47 and the abutment pins 58 and 57. The number of needles that the said thread carriers will serve with yarn will be in proportion to the distance between the abutment pins and the pins on the drums 19 and 20. As shown in the drawings the distance between the longest pins on either of the drums and the corresponding abutment pin is such as to allow for the feeding of about two needles for the first course in either direction and from opposite edges of the fabrics being knitted. As the pawls 31 and 32 operate for each second movement of the cock-box bar 14, shorter pins 55 and 56 will be brought into alinement therewith so that each thread carrier 44 and 45 will serve yarn to an increased number of needles for each reciprocation of the friction shaft 16. It will thus be seen that the splicing or reinforced courses formed by the said yarn

carriers 44 and 45 starting at opposite edges and increasing in length will form a reinforcement in which the inner line of intersection of the reinforced courses with the single thickness fabric will form an angle 100 to the edges 98 and 99 of each fabric.

When the fabric has been knitted to the points X', X', the respective dwell plates 69 and 70 on the drums 19 and 20 will move the pawls 81 and 82 out of rank with the ratchet wheels 25 and 26 and thereby stop the movement of the said drums. When the pattern pins 55 and 56 are in alinement with their respective abutment pins 58 and 57, the slide 51 is operated to engage both the forks 49' and 42' on the respective carrier rods 43 and 42' and the slide 50 is moved to engage both the forks 49' and 41' on the bars 50 and 41. A continued operation of the machine will then knit the heel flaps 101 and 102, the abutment pins 56 and 57 continuing to strike the low pins on the pattern drums 19 and 20. By coupling the forks as just described, the thread guides 43 and 44 will operate in unison to serve their threads for knitting one of the heel flaps while the thread guides 45 and 42' will move in unison to serve their threads to the needles to produce the other heel flap. It is thus obvious that the flaps 101 and 102 when made as described will each consist of a plurality of interknitted threads.

When it is desired to knit a stocking leg having reinforced selvage edges as shown in Figs. 9 and 11 the pawls 81 and 82 are raised out of engagement with respective ratchet wheels 25 and 26 and the drums are turned so that a pin of proper length is brought into alinement with the respective abutment pins 56 and 57 to form a reinforced selvage of the proper width throughout the length of the fabric from X', X' to Y', Y', the hooked pawls 79 being brought into engagement with the respective ratchet wheels on the drums 19 and 20; as shown in Fig. 9 in dot-and-dash lines. Then as the fashioning starts, due to the said longitudinal movement of the shaft 8, the hooks 79 will tend to rotate the drum so as to provide for the reinforcing at the narrowing of the fabric between the point Y', Y' to Y², Y². The fashioning mechanism is then thrown out of engagement and there is a straight selvage knitted up to the points Y², Y² after which the pawls 81 and 82 are again allowed to engage their respective ratchets and form a heel gusset in the manner as before stated and which merges from the said selvage. The heel flaps may be then knitted in the well known manner.

All machines of this type are made including the friction shaft and carrier rods very little change is required in providing the same with my invention.

In Figs. 13 and 14 I have shown two other forms of heel reinforcements which can be produced with my invention. In Fig. 14 while some of the lines of intersection run substantially at right angles to the courses, the "step" effect produces the gradual angle other than 90° to the courses.

I claim:

1. A machine for knitting full fashioned stocking webs with selvage edges, including a series of needles, means for supplying [illegible] web; means for supplying reinforcing yarn to those needles which knit the selvage edges and the portions of the web adjacent thereto to form a heel reinforcement; and means for rendering said latter yarn-supplying means operative to feed the reinforcing yarn to varying numbers of needles inwardly from the edge-producing needles during the knitting of successive courses to cause the inner ends of the courses of the heel reinforcement to define a line inclined to the wales and courses.

2. A machine for knitting full fashioned stocking webs with selvage edges, including a series of needles; a main yarn guide; means for moving said guide to supply yarn to the needles; a plurality of guides for supplying reinforcing yarn to the needles which knit the selvage edges and the portions of the web adjacent thereto near the ankle to form a heel reinforcement; and means for moving the reinforcing yarn guides different distances inwardly from the edge-producing needles in successive courses to cause the inner ends of the courses of the heel reinforcement to define a line inclined to the wales and courses.

3. A machine for knitting full fashioned stocking webs with selvage edges, including a series of needles; a main yarn guide; means for moving said guide to supply yarn to the needles; two guides for supplying reinforcing yarn to those of said needles which knit the selvage edges and portions adjacent thereto near the ankle to form a heel reinforcement; means for reciprocating the reinforcing yarn guides to also supply the reinforcing yarn to said latter needles; and means for stopping the reinforcing yarn guides at different points in successive courses to cause the inner ends of the courses of the heel reinforcement to define a line inclined to the wales and courses.

4. A machine for knitting full fashioned stocking webs with selvage edges, including a series of needles; a main yarn guide; means for moving said guide to supply yarn to the needles; two guides for supplying reinforcing yarn to those of said needles which knit the selvage edges and portions adjacent thereto near the ankle to form a heel reinforcement; means for reciprocating the reinforcing yarn guides to also supply the reinforcing yarn to said latter needles; and

means for stopping the reinforcing yarn guides at points gradually increasing in distance inwardly from the selvage edges in successive courses to cause the inner ends of the courses of the heel reinforcement to define a line inclined to the wales and courses.

5. A machine for knitting full fashioned stocking webs with selvage edges, including a series of needles; a main yarn guide; means for moving said guide to supply yarn to the needles; two guides for supplying reinforcing yarn to those of said needles which knit the selvage edges and portions adjacent thereto near the ankle to form a heel reinforcement; means for reciprocating the reinforcing yarn guides to also supply the reinforcing yarn to said latter needles; and automatically operated graduated stops for arresting the reinforcing yarn guides on their inward movements to cause the inner ends of the courses of the heel reinforcement to define a line inclined to the wales and courses.

6. The combination in a full fashion knitting machine of a series of needles; a main carrier rod; a yarn guide thereon; means for moving said carrier rod to actuate the main yarn guide and thereby serve yarn to the needles; a second carrier rod; a yarn guide thereon; a third carrier rod; a yarn guide on the third carrier rod; a friction shaft; means for moving the friction shaft; a pattern shaft; two pattern drums on said pattern shaft, each having pins of varying lengths; a friction box on said friction shaft having a member placed to engage the second carrier rod and a portion positioned to strike the pins of one of the pattern drums; a second friction box on said friction shaft having a portion positioned to engage the third carrier rod and a portion placed to strike the pins of the second pattern drum; means timed with the fashioning mechanism for actuating the pattern drums to move pins of different lengths into line with the contacting portions of the friction boxes; with a second and independent means for actuating the pattern drums.

7. The combination in a knitting machine of a series of needles; a main yarn guide; a carrier therefor; means for moving said carrier; a reinforcing yarn guide; a carrier therefor; a cockbox bar; a friction shaft secured to said bar; means for actuating said bar; a pattern drum; a ratchet on said drum; a friction box on said friction shaft having a portion positioned to engage said second carrier and another portion placed to strike said pattern drum; a pawl for engagement with the ratchet; and means actuated by the movement of the cockbox bar for moving said pawl and thereby actuating the drum to bring different portions thereof into line with the contacting portions of said friction box.

8. The combination in a knitting machine of a series of needles; a main carrier rod; a yarn guide secured to said rod; means for moving the rod; a second carrier rod; a yarn guide secured thereto; a third carrier rod; a yarn guide secured to said third rod; a cock-box bar; a friction shaft secured thereto; means for moving the cock-box bar; a pattern shaft; a pattern drum on said shaft; a ratchet on said pattern drum; a series of pins of varying lengths secured in said drum; a second pattern drum on said pattern shaft; a ratchet on the latter drum; a series of pins of varying lengths secured to said drum; a friction box on the friction shaft having a portion adapted to engage the second carrier rod and another portion adapted to strike the pins on the first pattern drum; a second friction box on the friction shaft having a portion placed to engage the third carrier rod and having a second portion adapted to coöperate with the pins on the second pattern drum; pawls for engagement with the ratchet wheels; and means actuated by the movement of the cock-box bar to effect the movement of the said pawls to move the drums and thereby bring pins of different lengths into alinement with the contacting portions of the friction boxes.

9. The combination in a knitting machine of a series of needles; a main carrier rod; a yarn guide secured to said rod; means for moving the rod; a second carrier rod; a yarn guide secured thereto; a third carrier rod; a yarn guide secured to the same; a cock-box bar; a friction shaft secured thereto; means for moving the cock-box bar; a pattern shaft; a pattern drum on said shaft; a ratchet on said drum; a series of pins of varying lengths secured in the drum; a second pattern drum on said pattern shaft; a ratchet on the latter drum; a series of pins of varying lengths secured to the second pattern drum; a friction box on said friction shaft having a portion adapted to engage the second carrier rod and a portion adapted to strike the pins on the first pattern drum; a second friction box on the friction shaft having a portion placed to engage the third carrier rod and having another portion adapted to strike the pins on the second pattern drum; pawls for engagement with the ratchet wheels; cams mounted on the cock-box bar in position to actuate said pawls and move the pattern drums to bring pins of different lengths into alinement with the contacting portions of the friction boxes; and means for automatically disengaging said pawls from their respective ratchets.

10. The combination in a knitting machine of a series of needles; a main carrier rod; a yarn guide secured to said rod; means for moving the rod; a second carrier rod; yarn guide secured thereto; a cock-box bar;

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a friction shaft secured to said cock-box bar; means for moving the cock-box bar; a pattern shaft; a pattern drum thereon; a ratchet on said drum; a series of pins of varying lengths secured in the drum; a second pattern drum on said pattern shaft; a ratchet on said second drum; a series of pins of varying lengths secured to the second pattern drum; a friction box on the friction shaft having a portion adapted to engage the second carrier rod and a portion adapted to strike the pins on the first pattern drum; a second friction box on the friction shaft having a portion capable of engaging the third carrier rod and having a portion placed to engage the pins on the second pattern drum; pawls placed to respectively engage said ratchet wheels; cams mounted on the cock-box bar and operating to effect movement of the said pawls to more respective pattern drums and thereby bring pins of different lengths into alinement with the contacting portions of the friction boxes; means for automatically disengaging said pawls from their respective ratchets; two other pawls placed to respectively engage said ratchets; and means, independent of the cock-box bar, for moving said latter pawls to cause the said drums to bring pins of different lengths into alinement with the contacting portions of the friction boxes.

11. The combination in a knitting machine of a series of needles; a main carrier rod; a yarn guide secured to said rod; means for moving the rod; a second carrier rod; a yarn guide secured thereto; a cock-box bar; a friction shaft secured to said cock-box bar; means for moving the cock-box bar; a pattern shaft; a pattern drum on said shaft; a ratchet on said drum; a series of pins of varying lengths secured in said drum; a second pattern drum on the pattern shaft; a ratchet on said second drum; a series of pins of varying lengths secured to the second pattern drum; a friction box on the friction shaft having a portion placed to engage the second carrier rod and a portion positioned to strike the pins on the first pattern drum; a second friction box on the friction shaft having a portion capable of engaging the third carrier rod and having a second portion adapted to engage the pins on the second pattern drum; pawls placed to respectively engage the ratchet wheels; cams mounted on the cock-box bar and operating to effect movement of the pawls and drums to bring pins of different lengths into alinement with the contacting portions of the friction boxes; means for automatically disengaging said pawls from their respective ratchets; two other pawls placed to respectively engage the ratchets; means independent of the movement of the cock-box bar for moving said latter pawls to cause the drums to bring pins of different lengths into alinement with the contacting portions of the friction boxes; and means for adjusting said latter portions of the friction boxes to compensate for wear.

12. The combination in a knitting machine of a series of needles; a main carrier rod; a yarn guide secured to said rod; means for moving the rod; a second carrier rod; a yarn guide secured thereto; a third carrier rod; a yarn guide secured to said third carrier rod; a cock-box bar; a friction shaft secured thereto; means for moving the cock-box bar; a pattern shaft; a pattern drum on said shaft; a ratchet on said drum; a series of pins of varying lengths secured in said drum; a second pattern drum on said pattern shaft; a ratchet on said second drum; a series of pins of varying lengths secured to the second pattern drum; a friction box on the friction shaft having a portion adapted to engage the second carrier rod and a portion adapted to strike the pins on the first pattern drum; a second friction box on the friction shaft having a portion capable of engaging the third carrier rod and having a second portion adapted to engage the pins on the second pattern drum; pawls placed to respectively engage the ratchet wheels; cams mounted on the cock-box bar and respectively operative to effect movement of said pawls and pattern drums to bring pins of different lengths into alinement with the contacting portions of the friction boxes; means for automatically disengaging said pawls from their respective ratchets; two other pawls mounted to respectively engage the ratchets; a fashioning shaft; and means actuated by said shaft for effecting movement of the said latter pawls to move the said drums to bring pins of different lengths into contacting alinement with the said contacting portions of the friction boxes.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GUSTAV A. LANDENBERGER.

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WM. A. BARR.

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T. LIEBERKNECHT.

STRAIGHT HOSIERY FRAME.

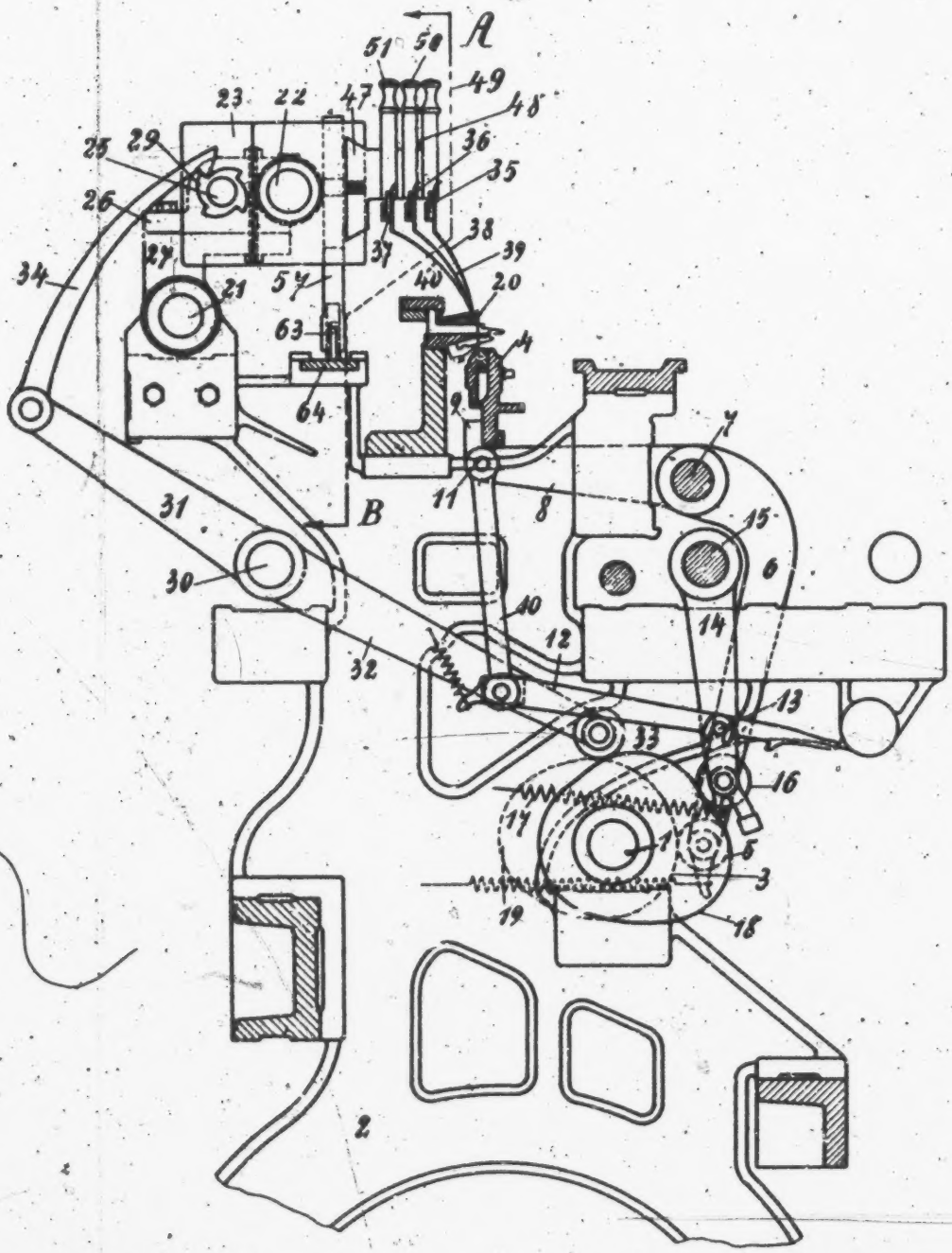
APPLICATION FILED MAY 25, 1910.

981,663.

Patented Jan. 17, 1911.

5 SHEETS—SHEET 1.

Fig. 1



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5 SHEETS—SHEET 2.

Fig. 2

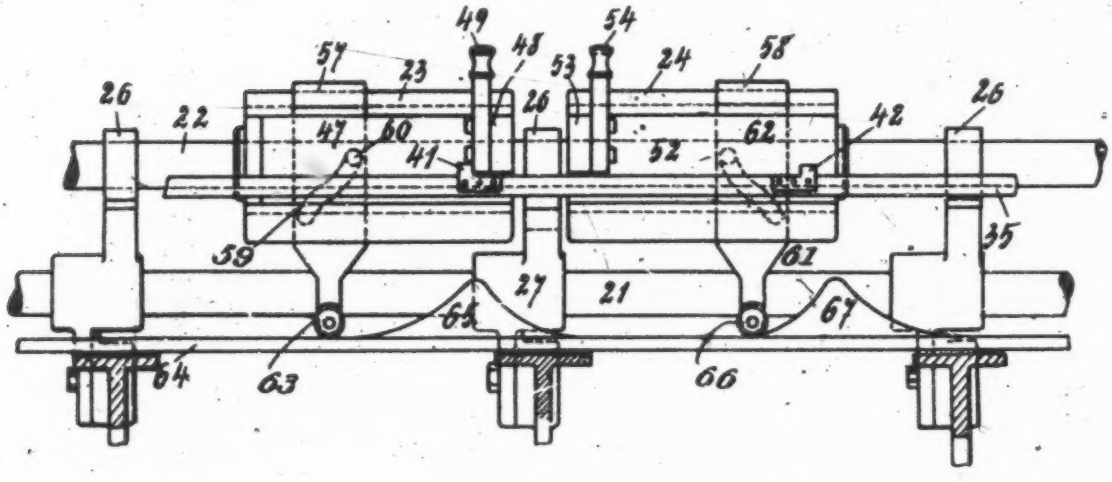
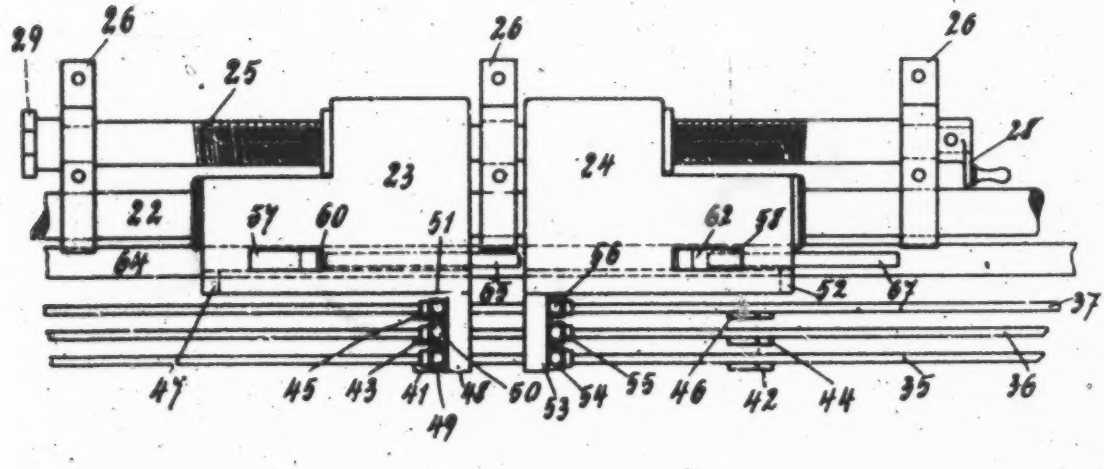


Fig. 3



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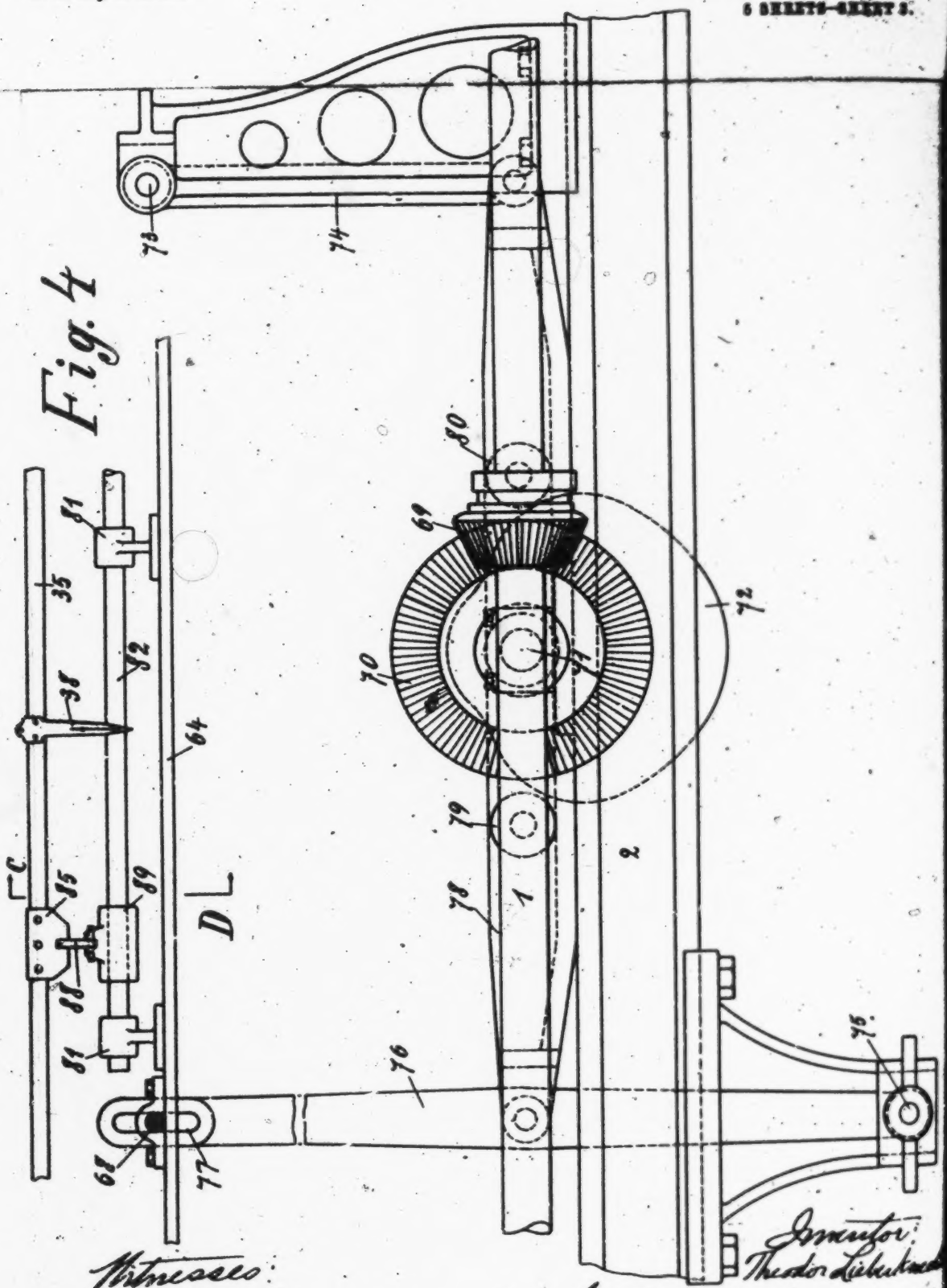
5 SHEETS-SHEET 3.

Fig. 4



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5 SHEETS—SHEET 4.

Fig. 5

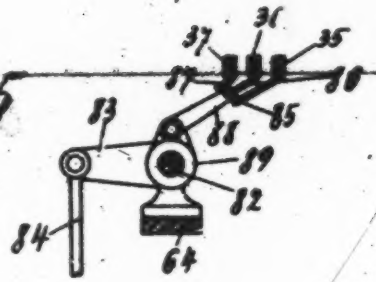
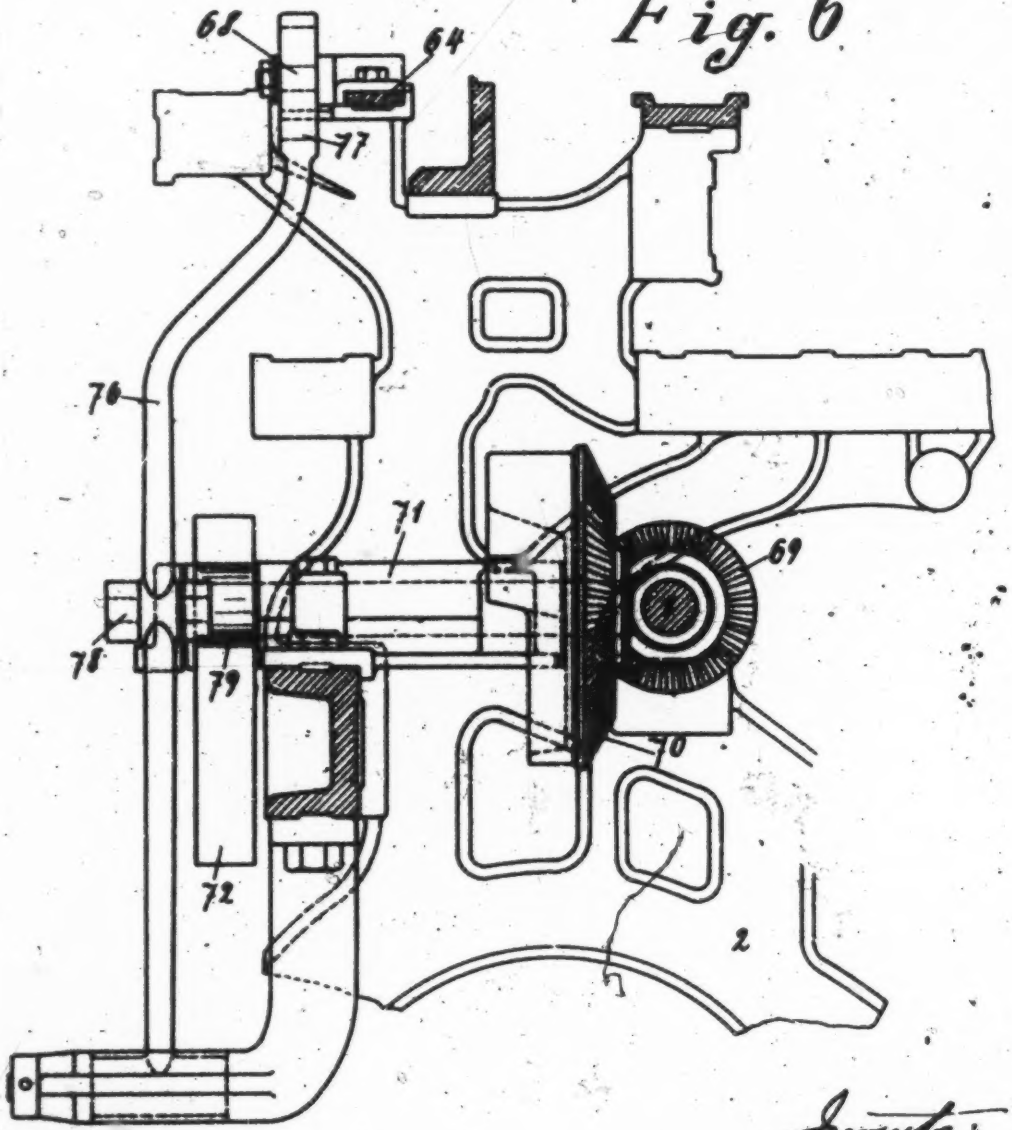


Fig. 6



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APPLICATION FILED MAY 26, 1910.

981,663. Patented Jan. 17, 1911.

5 SHEETS—SHEET 5.

Fig. 7

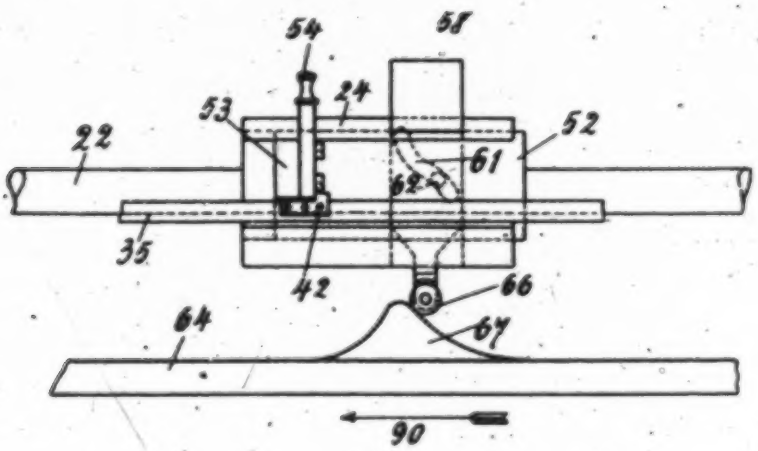
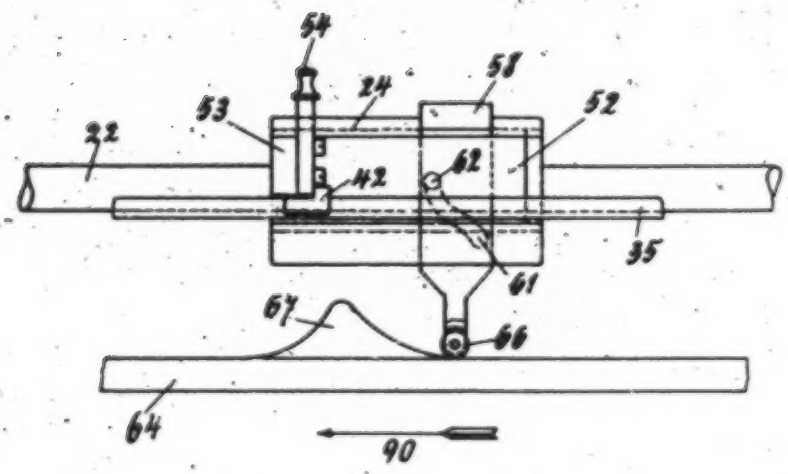


Fig. 8



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UNITED STATES PATENT OFFICE.

THEODOR LIEBERKNECHT, OF HOHENSTEIN-ERNSTTHAL, GERMANY.

STRAIGHT HOSIERY-FRAME.

981,663. Specification of Letters Patent. Patented Jan. 17, 1911.

Application filed May 25, 1910. Serial No. 563,288.

To all whom it may concern:

Be it known that I, THEODOR LIEBERKNECHT, a citizen of the Empire of Germany, residing at Hohenstein-Ernstthal i. S., in the Empire of Germany, have invented a new and useful Straight Hosiery-Frame, of which the following is a specification.

My invention relates to improvements in straight hosiery frames adapted to simultaneously produce a number of like hosiery pieces, whereby the shocks or blows produced by the yarn guide bars striking the known shiftable stops are considerably softened or nearly annihilated, so that the machines can be driven at a greater speed than hitherto and consequently their output will be increased. I provide the straight hosiery frame with two main slides guided in the frame proper and operated by a screw-spindle with right- and left-handed threads. Each main slide is provided with a subsidiary slide guided in it parallel to the yarn guide bars. On each subsidiary slide as many adjustable stops are provided, as there are yarn guide bars, each stop being adapted to come in contact with one lug on any of the yarn guide bars and to move with same while retarding it, until both stop. In each main guide moreover a controlling slide is guided in a direction at right angles to the yarn guide bars and the controlling slide is provided with a crooked slot, in which a pin on the subsidiary slide engages. I further provide the machine with a cam bar parallel to the yarn guide bars, which cam bar is guided in the frame proper and has two cams, over which rollers at the lower ends of the two controlling slides can roll, so that by the cams the controlling slides can be alternately raised and lowered, while at the same time by the controlling slides the subsidiary slides are longitudinally moved in one and the other direction.

Means are provided for longitudinally reciprocating the cam bar and for periodically and yieldingly connecting the cam bar with any of the yarn guide bars. The said crooked slots in the two controlling slides and the said two cams are so shaped, that shortly before the end of any stroke of the yarn guide bar then in motion the respective subsidiary slide is first moved through a certain distance in a direction opposite to that of the yarn guide bar and the motion of the subsidiary slide is then reversed at the moment that its respective stop is about to come in contact with the corresponding lug of the yarn guide bar, so that the shock or blow produced by the lug striking the stop is considerably softened or annihilated, the more so, since by the stop moving with the subsidiary slide in the same direction the motion of the lug and of its bar is gradually retarded, until both stop at the moment that the motion of the yarn guide bar is reversed. The said screw-spindle with right- and left-handed threads serves for feeding the two main slides in opposite directions during the widening or narrowing of the goods, in other words for varying the stroke of the yarn guide bar.

I will now proceed to describe my invention with reference to the accompanying drawings, in which—

Figure 1 is a vertical central cross section through a Cotton type straight hosiery frame provided with the improvements according to my invention, only so much of the machine being shown as is necessary for giving a sufficient idea. Fig. 2 is a vertical longitudinal section through the broken line A—B in Fig. 1 and shows the middle part of the machine. Fig. 3 is a plan view of the parts shown at Fig. 2. Fig. 4 is a front elevation of the parts in the middle portion of the frame. Fig. 5 is a vertical cross section through the line C—D in Fig. 4, seen in the direction of the arrows. Fig. 6 is a vertical cross section through the straight hosiery frame on a line to the left of the parts shown in Fig. 4, only those portions of the mechanism required to illustrate the invention being shown. Fig. 7 is a detail view of some of the parts shown in Fig. 2, with the cam bar in another position, and Fig. 8 is a similar view and shows the cam bar in a third position.

Similar characters of reference refer to similar parts throughout the several views.

In the drawings I have shown for example a straight hosiery frame of the known Cotton's construction, which is adapted to simultaneously produce a number of like goods. A cam shaft 1 is mounted in the frame 2 to turn and is arranged to be driven from some countershaft by means of gearing (not shown) and carries various cam disks, of which only a few are shown at Fig. 1. The cam disks 3 are adapted to operate the machine needle bar 4 by means of rollers 5, arms 6, a rocking shaft 7 and arms 8.

The frame needle bar 4 is fastened on the upper short arms 9 of two-armed levers 9, 10, which are mounted to a rock on pins 11 at the free ends of the arms 8, while their lower long arms 10 are pivotally connected by rods 12 with pins 13 on arms 14 fastened on a rocking shaft 15. The arms 14 carry rollers 16 and are therewith pressed by helical springs 17 against the periphery of cam disks 18 on the cam shaft 1, while the above mentioned rollers 5 are pressed by helical springs 19 against their cam disks 3. In this manner the frame needle bar 4 can be raised and lowered by the parts 3, 5, 6, 7, 8 and rocked about the pins 11 as usual.

The frame needles are denoted by 20, but I do not further describe them, nor the sinkers working them, as they are immaterial to my invention.

Two parallel horizontal rods 21 and 22 are provided in the frame 2 and two opposite main slides 23 and 24 are mounted on the upper rod 22 to longitudinally move. The two main slides 23 and 24 form nuts of a horizontal left- and right-handed screw-spindle 25, which is mounted to turn in three bearings 26, 26 loose on the rod 22. The bearings 26, 26 are rigidly connected with three supports 27, 27, which are loose on the lower rod 21. The middle bearing 26 is assumed to be located in the middle of the hosiery frame, and it will be seen, that by the three bearings 26, 26 and the three supports 27, 27 the two main slides 23 and 24 are prevented from turning on the rod 22. The screw-spindle 25 carries at the right end in Fig. 3 a hand-crank 28 and at the left end a ratchet wheel 29 with four teeth. Loose on a shaft 30 forming part of the hosiery frame is a two-armed lever 31, 32, of which the upper arm 31 carries a long pawl 34 engaging the ratchet wheel 29 and the lower arm 32 carries a roller 33 adapted to roll on one of the cam disks 3. It will be understood, that by means of the pawl 34, the ratchet wheel 29 and the screw-spindle 25 the two main slides 23 and 24 can be fed toward one another to control the traverse of the yarn guides when narrowing the goods and after finishing the goods or their portions the two main slides can be returned to their initial position by turning the hand-crank 28. Three yarn guide bars 35, 36, 37 parallel to the two rods 21 and 22 and to the series of frame needles 20 are shown to be provided, which are mounted in the frame 2 to longitudinally reciprocate and carry yarn guides 38, 39, 40 (Fig. 1), of which only one 38 is shown in Fig. 4. The yarn guide bars 35, 36, 37 have fastened on them near their middle two lugs each, viz. 41 and 42 on the bar 35, 43 and 44 on the bar 36, 45 and 46 on the bar 37. A subsidiary slide 47 is horizontally guided in one main slide 23 and has an arm 48, on which three vertically adjustable stops 49, 50, 51 are shown to be provided about in the vertical planes of the three yarn guide bars 35, 36, 37. Another subsidiary slide 52 opposite to the first one 47 is guided in the other main slide 24 and has an arm 53, on which three vertically adjustable stops 54, 55, 56 are provided. The lug 41 of the yarn guide bar 35 is adapted to come in contact with the stop 54, whereby the bar is stopped, and the other lug 42 is adapted to come in contact with the stop 49 for stopping the bar 35. The two lugs 43 and 44 of the second yarn guide bar 36 are in a similar manner adapted to work with the stops 50 and 55, and the two lugs 45 and 46 of the third yarn guide bar 37 are adapted to work with the two stops 51 and 56 respectively. A controlling slide 57 is vertically guided in one main slide 23 and a second controlling slide 58 in the other main slide 24. The controlling slide 57 has a crooked oblique slot 59, in which a pin 60 on the subsidiary slide 47 engages. The other controlling slide 58 has an opposite slot 61, in which a pin 62 on the other subsidiary slide 52 engages. The controlling slide 57 carries at its lower end a roller 63, which is adapted to roll on a cam bar 64 and over a cam 65 provided on the latter. The other controlling slide 58 likewise carries at its lower end a roller 66, which is adapted to roll on the cam bar 64 and over a second cam 67. The two controlling slides 57 and 58 may be pressed downward by their own weight or by springs of any known kind (not shown).

The cam bar 64 is horizontally guided in the frame 2 and carries a pin 68 which is operated from the cam shaft 1 in the following manner. A small bevel wheel 69 splined on the cam shaft 1 meshes with a large bevel wheel 70 keyed upon a shaft 71, which turns in the frame 2 and has fastened on it at the rear end a cam disk 72. A suitable part of the frame 2 carries a pin 73 on which a link 74 is mounted to rock, and another part of the frame 2 carries a pin 75, on which a lever 76 can rock. At the upper end the lever 76 has a slot 77, in which the said pin 68 engages. The link 74 is pivotally connected with the lever 76 by a rod 78 carrying two rollers 79 and 80 which are adapted to simultaneously roll on the periphery of the cam disk 72 from opposite sides. As the diameter of the large bevel wheel 70 is twice that of the small bevel wheel 69, it will be understood, that on every revolution of the cam shaft 1 the cam bar 64 will make one stroke in either direction. The parts 69, 70, 71, 72, 73, 74, 75, 76, 78, 79, 80 are substantially the same as similar parts of the yarn guide traverse mechanism to be found on any known Cotton's hosiery frame, the only difference being, that they actuate the cam bar 64 and not the known slide carrying

the yarn guide bars. The cam bar 64 carries several bearings 81, 81, in which a shaft 82 is mounted to rock, while it is in any known manner prevented from longitudinal motion, so that it is obliged to partake in the reciprocating motion of the cam bar 64. The right end of the shaft 82 in Fig. 4 passes through the nave of an arm 83 (Fig. 5) and is provided with a groove, in which a feather in this nave engages. The arm 83 is in any known manner prevented from endwise motion and is pivotally connected with a vertical rod 84, which is operated from any known device that ordinarily serves for periodically changing the connection shown at 85, 88, 89 from one yarn guide bar to any of the other yarn guide bars. The three yarn guide bars 35, 36, 37 have fastened on them inclined forks 85, 86, 87 respectively, into any of which an arm 88 fastened on a sleeve 89 can engage. The sleeve 89 is in any known manner prevented from turning on the shaft 82 and is frictionally held thereon, so that it normally moves together with the latter, but on being stopped in a manner to be described later on it can slide on the shaft 82.

The straight hosiery frame operates as follows: By turning the hand-crank 28 the two main slides 23 and 24 are moved away from one another into their initial position. When the machine is in working order and at a moment the arm 88 on the sleeve 89 engages the fork 85 on the front yarn guide bar 35 and the cam bar 64 is moved from right to left in the direction of the arrow 90 in Figs. 7 and 8, about in the middle of the stroke of the cam bar 64 the roller 66 of the right controlling slide 58 will occupy the position shown at Fig. 2, so that it is about to roll on the cam 67. Then it will raise the controlling slide 58 and at the same time the subsidiary slide 52 will be moved by its pin 62 engaging in the slot 61 of the controlling slide 58 in a direction opposite to that of the arrow 90. On about 70% of the stroke being completed, the roller 66 will be on the summit of the cam 67, so that the pin 62 engages in the deepest portion of the crooked slot 61 and consequently the subsidiary slide 52 occupies its extreme position on the right and its stop 54 will be but at a small distance from the lug 42 of the yarn guide bar 35, which latter has been moved along with the cam bar 64. Shortly afterward the roller 66 commences to descend, as is shown at Fig. 7, so that the pin 62 of the subsidiary slide 52 engages in the crooked slot 61 at a point above the lower end of the latter, which means, that the subsidiary slide 52 has been moved through a small distance in the direction of the arrow 90. At the same time by the cam bar 64 the front yarn guide bar 35 has also been moved forward in the same direction, so that its lug 42 just comes in contact with the stop 54, as is clearly shown at Fig. 7. During the continued motion of the cam bar 64 in the direction of the arrow 90 the pin 62 of the subsidiary slide 52 will relatively move in the slot 61 of the controlling slide 58 upward, which means, that the subsidiary slide 52 will move more slowly in the direction of the arrow 90 than the cam bar 64 and the yarn guide bar 35 and consequently it will retard by its stop 54 and the lug 42 the yarn guide bar 35. At the moment that the roller 66 is about to leave the cam 67 (see Fig. 8), the pin 62 of the subsidiary slide 52 engages in the upper end of the crooked slot 61, so that both the stop 54 and the lug 42 will stop and the yarn guide bar 35 will be prevented from further moving, while the cam bar 64 may continue moving farther, before it stops and its motion is reversed. It is obvious, that in this manner any shock or blow between the stop 54 and the lug 42 can be avoided.

During the described motion of the cam bar 64 in the direction of the arrow 90, of course also the roller 63 of the left controlling slide 57 will have rolled over the left cam 65, so that the oppositely inclined slot 59 in the left controlling slide will by the pin 60 have moved the left subsidiary slide 47 first in the direction of the arrow 90 and afterward in the opposite direction. As, however, in the meantime the other lug 41 of the front yarn guide bar 35 remains out of reach of the stop 49, no effect will be produced by the left cam 65 during the stroke in the direction of the arrow 90. It is only during the stroke in the opposite direction, that the left cam 65 is able to produce a gradual and silent stoppage of the front yarn guide bar 35 by means of the stop 49 and the lug 41 in a similar manner as explained above with reference to the right cam 67. The sleeve 89 frictionally held on the shaft 82 permits it to vary the stroke of any of the yarn guide bars 35, 36, 37, while the stroke of the cam bar 64 remains constant, so that the goods can be widened or narrowed as usual. The ratchet wheel 29 on the screw-spindle 25 is fed one tooth forward by the pawl 34 for every revolution of the cam shaft 1, so that the two main slides 23 and 24 are simultaneously moved together through the distance of one or several pitches of the frame needles 20, as the case may be, whereby the stroke of any of the yarn guide bars 35, 36, 37 is gradually shortened as usual.

When by the mentioned known device the rod 84 (Fig. 5) is so actuated, as to move by the arm 83 and the shaft 82 the arm 88 of the sleeve 89 out of engagement with the fork 85 of the front yarn guide bar 35 into engagement with say the fork 87 of the rear yarn guide bar 37, the latter will be alter-

nately and gradually stopped by the two adjustable stops 51 and 56 in a similar manner to that described above with reference to the front yarn guide 35.

When by turning the hand crank 28 the two main slides 23 and 24 are moved away from one another and brought into their initial position, and the cam bar 64 occupies its extreme right position, about as is shown at Fig. 2, the rollers 63 and 66 of the two controlling slides 57 and 58 may occupy about the position shown at Fig. 2, so that at the end of the stroke of the cam bar 64 in the direction of the arrow 90 the right roller 66 will be on the right side of the cam 67 at a distance from the commencement of the cam, which distance may be about like the length of the cam 67. Then during the narrowing of the goods the distance of the two main slides 23 and 24 will be gradually diminished, until for the minimum distance of the two main slides 23 and 24 and for the extreme left position of the cam bar 64 the right roller 66 is about above the commencement of the cam 67 on its right side in Fig. 2. In a similar manner the left cam 65 may be proportioned with regard to the right roller 63.

The new mechanism described can be varied in many respects without departing from the spirit of my invention.

I claim:

1. In a straight hosiery frame, the combination with a frame, of two main slides guided in said frame, yarn guide bars guided in said frame and having two lugs each, two subsidiary slides guided in said two main slides, a cam bar guided in said frame parallel to said yarn guide bars and provided with two cams, means operated from said cam bar and its two cams for reciprocating said two subsidiary slides, stops on said two subsidiary slides, each stop being adapted to come in contact with one lug of the corresponding yarn guide bar and to move with same while retarding it until both stop, a mechanism for feeding said two main slides in opposite directions, means for yieldingly connecting any of said yarn guide bars with said cam bar, and means for longitudinally reciprocating said cam bar.

2. In a straight hosiery frame, the combination with a frame, of two main slides guided in said frame, yarn guide bars guided in said frame and provided with two lugs each, two subsidiary slides guided in said two main slides parallel to said yarn guide bars and having each a pin, a cam bar guided in said frame parallel to said yarn guide bars and provided with two cams, two controlling slides guided in said two main slides at right angles to said cam bar and adapted to bear on same and its two cams, each controlling slide having an inclined slot opposite to that of the other controlling slide which slot is adapted to guide the pin of the corresponding subsidiary slide, stops on said two subsidiary slides, each stop being adapted to come in contact with one lug of the corresponding yarn guide bar and to move with same while retarding it until both stop, a mechanism for feeding said two main slides in opposite directions, means for yieldingly connecting any of said yarn guide bars with said cam bar, and means for longitudinally reciprocating said cam bar.

3. In a straight hosiery frame, the combination with a frame, of two main slides guided in said frame, a screw-spindle with right- and left- handed threads mounted in said frame to turn and engaging said two main slides, means for feeding said screw-spindle, yarn guide bars guided in said frame and provided with two lugs each, two subsidiary slides guided in said two main slides parallel to said yarn guide bars and having each a pin, a cam bar guided in said frame parallel to said yarn guide bars and provided with two cams, two controlling slides guided in said two main slides at right angles to said cam bar, two rollers at said two controlling slides adapted to roll on said cam bar and its two cams, each controlling slide having an inclined slot opposite to that of the other controlling slide which slot is adapted to guide the pin of the corresponding subsidiary slide, stops on said two subsidiary slides, each stop being adapted to come in contact with one lug of the corresponding yarn guide bar and to move with same while retarding it until both stop, means for yieldingly connecting any of said yarn guide bars with said cam bar, and means for longitudinally reciprocating said cam bar.

4. In a mechanism of the character described, the combination with a frame, of a reciprocatory yarn guide bar mounted in the frame and provided with two suitably spaced lugs, two stops mounted on the frame and adapted to coöperate with the lugs on said yarn guide bar to limit the reciprocatory movement of said bar, and means for imparting a relative movement between each of said stops and the coöperating lug, independent of the movement of the yarn guide and in the direction of the length of said bar, as the bar approaches the limit of its travel in either direction, whereby the lug and stop will contact without appreciable jar or shock.

5. In a mechanism of the character described, the combination with a frame, of a reciprocatory yarn guide bar mounted in the frame and provided with two suitably spaced lugs, two stops mounted on the frame and adapted to coöperate with the lugs on said yarn guide bar to limit the reciprocatory movement of said bar, and means for alter-

nately reciprocating the stops in the direction of the length of the yarn guide bar as the bar approaches the limit of its movement in opposite directions to cause the lugs and stops to contact without appreciable shock.

6. In a mechanism of the character described, the combination with a frame, of a reciprocatory yarn guide bar mounted in the frame and provided with two suitably spaced lugs, two stops mounted on the frame and adapted to coöperate with the lugs on said yarn guide bar to limit the reciprocatory movement of said bar, means for simultaneously moving said stops in opposite directions, and means for alternately moving said stops in a direction opposite to that in which the bar is moving, and toward the coöperating lug on said bar, the stop being returned to its previous position by the movement of said bar.

7. In a knitting machine having a traversing yarn guide, the combination of a bar for traversing said guide, friction driving means for traversing said bar, abutment stops to limit the traverse of said yarn guide, and means to cause said stops to move with the bar but at a less rate when the end of the traverse is approached to gradually check and stop said movement.

THEODOR LIEBERKNECHT.

Witnesses:

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Dec. 8, 1925. 1,564,438

J. MULLER

ATTACHMENT FOR KNITTING MACHINES

Filed Oct. 20, 1923 2 Sheets-Sheet 1

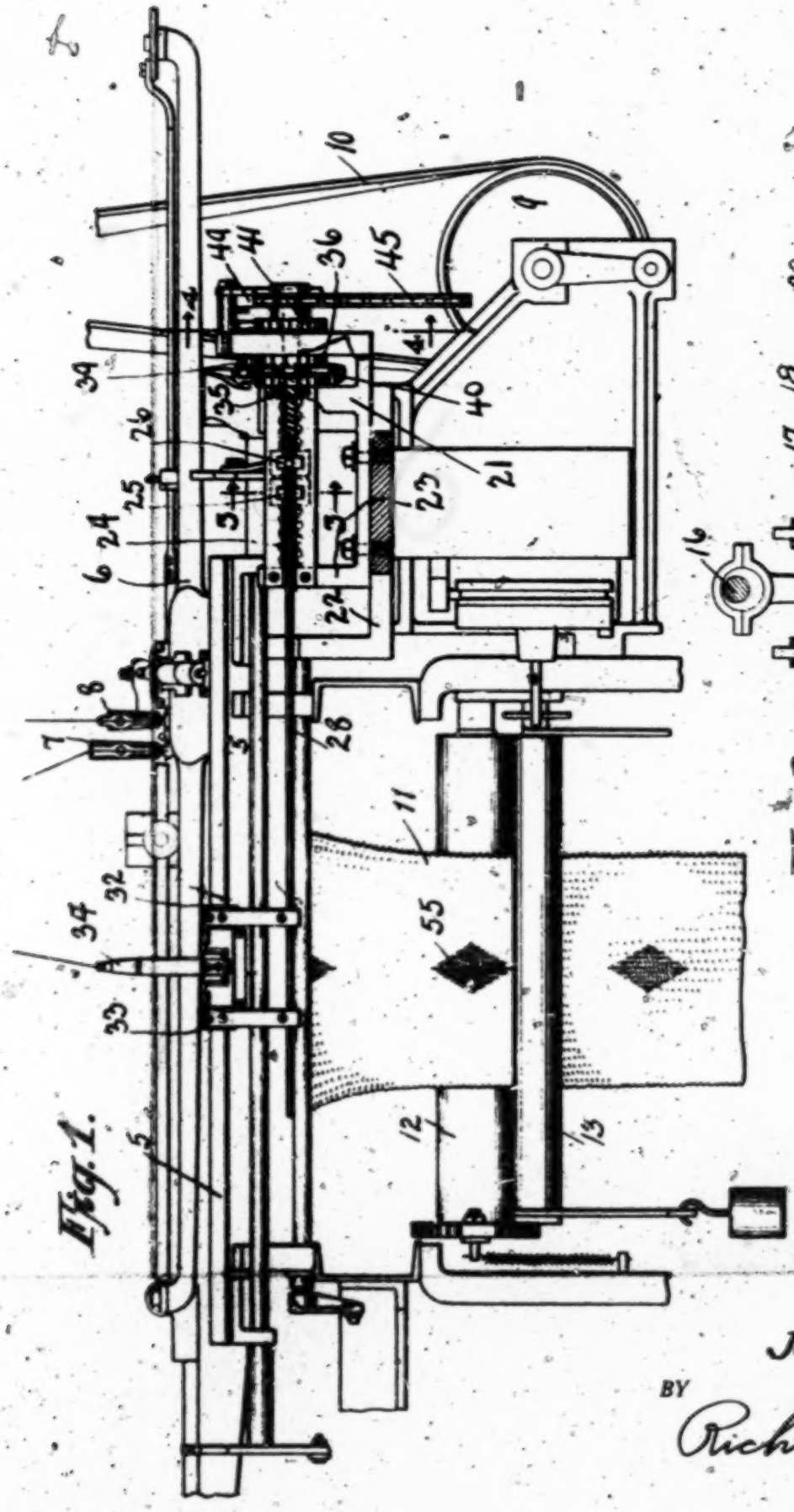

Fig. 1.

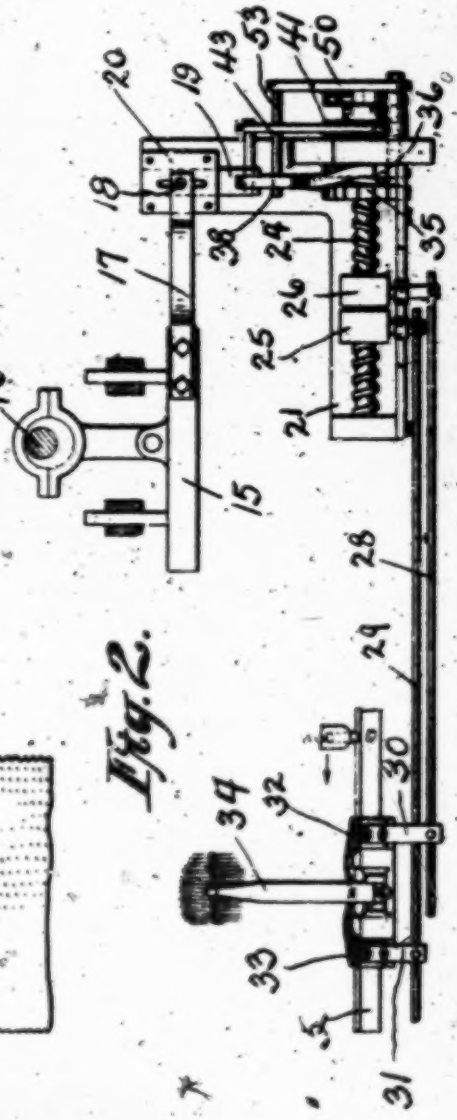

Fig. 2.

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Fig. 3.

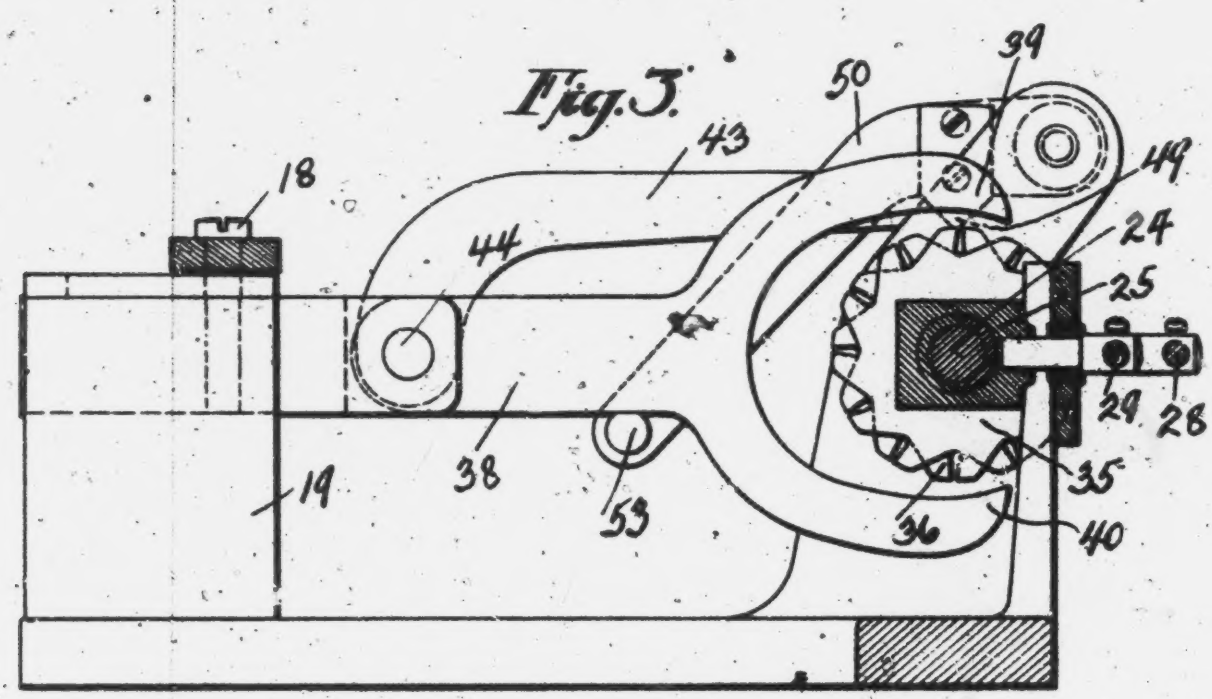
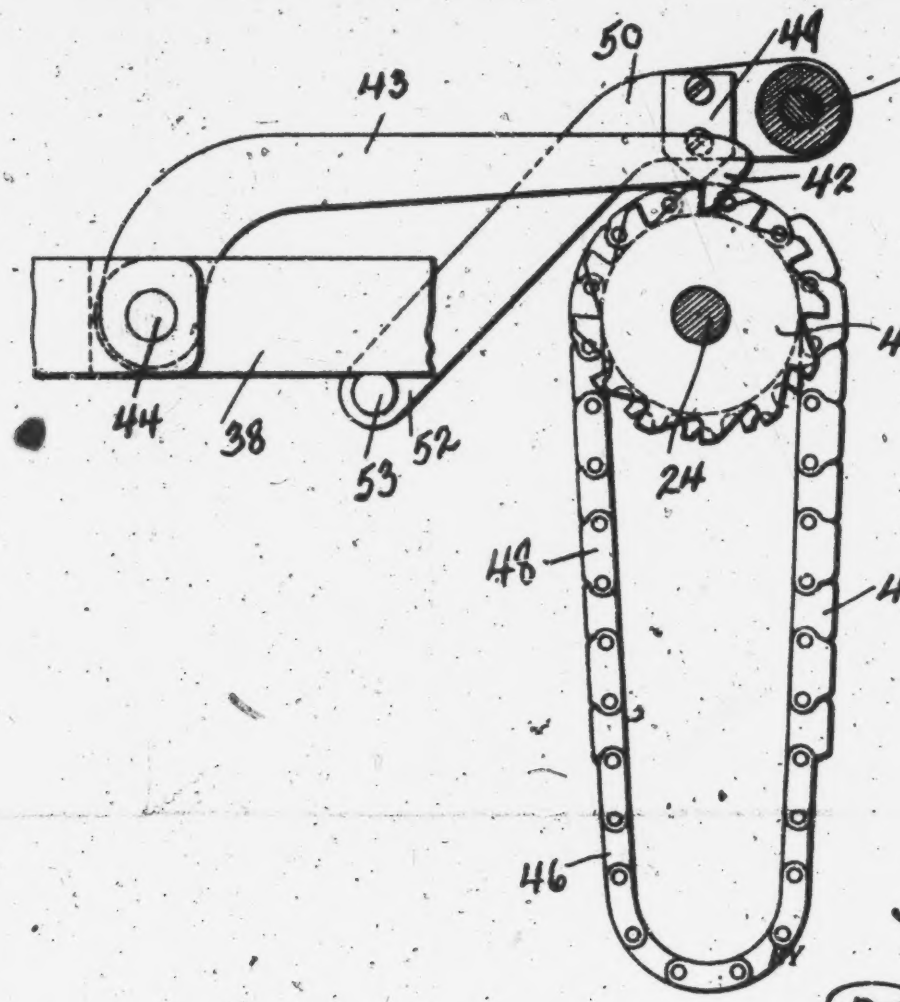


Fig. 4.



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Patented Dec. 8, 1925. 1,564,438

UNITED STATES PATENT OFFICE.

JOHN MULLER, OF BROOKLYN, NEW YORK.

ATTACHMENT FOR KNITTING MACHINES.

Application filed October 20, 1923. Serial No. 669,222.

To all whom it may concern:

Be it known that I, JOHN MULLER, a citizen of Yugoslavia, residing at Brooklyn, in the county of Queens and State of New York, have invented certain new and useful Improvements in Attachments for Knitting Machines, of which the following is a specification.

This invention relates to attachments for knitting machines and more particularly to a novel and improved mechanism for knitting various designs or objects in arbitrary spaced relation and of different color.

The primary object of my invention is to provide an attachment or mechanism to a knitting machine and operable therewith wherein the yarn carrier stoppers and a yarn carrier may be moved relative to each other at predetermined intervals without effecting the operation of the rear yarn carriers whereby arbitrary objects of different color may be knitted.

Another object of my invention is to construct a novel and improved mechanism which can be attached or connected to the forwardly and rearwardly movable bar operable by the eccentric of a flat knitting machine, including provision for intermittently moving the yarn carrier stoppers relative to each other at predetermined intervals thus permitting the knitting of various colored designs without stopping the operation of the machine.

Another object of my invention is to provide a knitting attachment of the character above specified adapted to be connected or attached to the operating mechanism of a knitting machine including mechanism for automatically and uniformly moving or spacing a pair of yarn carriers proper and reversing their direction of movement at predetermined intervals whereby various designs or figures of different colored yarns or threads may be knitted on the main strip or breadth of material.

To enable others skilled in the art to fully comprehend the underlying features of my invention that they may embody the same in the various modifications in structure and relation contemplated, drawings depicting a preferred form have been annexed as a part of this disclosure and in such drawings, similar reference characters denote corresponding parts thoughout all the views, of which,

Figure 1 is a front view showing the knitting machine and the relative position of the attachment connected thereto.

Figure 2 is a view of the attachment or mechanism connected to the forwardly and rearwardly movable bar operable by the eccentric and also showing the relative position of the yarn carrier stoppers and the yarn carrier.

Figure 3 is an enlarged view, taken substantially on the line 3—3 of Figure 1.

Figure 4 is a further view taken substantially on the line 4—4 of Figure 1.

Referring now to the drawing wherein like reference characters designate corresponding parts throughout the several views, 5 designates the stationary carrier bar and 6, the movable carriage which operates from the right to the left during the operation of the rear yarn carrier shown by numerals 7 and 8, all of said mechanism being operable by the pulley and belt construction 9, 10, commonly known in the art as the flat knitting machine. The knitted material is indicated at 11 and extends downwardly between a pair of rollers 12, 13, below the stationary yarn carrier bar 5, above referred to. The flat knitting machine also includes the bar 15 which is operated backward and forwardly by an eccentric 16, shown clearly by Figure 2 of the drawings, the last mentioned bar constituting the operating or driving means for actuating the mechanism now to be described in detail.

Attached to one end of the bar 15, I have provided a bracket 17, the outer end of which is connected by a bolt 18 to a sliding block 19. The block is positioned at the inner end 20 of a U-shaped casting 21, bolted to the stationary part of the frame 22 by suitable fastening elements clearly shown by Figure 1 of the drawings. Journaled between the upright legs 23 of the U-shaped casting, I have provided a right and left hand screw 24 on which a pair of internally threaded nuts or blocks 25, 26 are positioned. A pair of horizontal transversely, extending, parallel connecting rods 28, 29 are connected to the blocks 25, 26, and to the flat, depending metal strips 30, 31 of a pair of yarn carrier stoppers 32, 33, which control the relative movement of a front yarn carrier 34, which yarn carrier, of course, cooperates with the needles of the knitting machine. In other words, the yarn carrier stoppers 32, 33, are spaced relative to each other, the yarn carrier 34 may move horizontally and

effect only those needles in its path of movement and consequently, the greater the movement of the yarn carrier, the greater the number of needles and consequently, the greater the number of stitches are made. It will therefore be seen that by spacing the yarn carrier stoppers, an arbitrary distance on the yarn carrier bar 5, the front yarn carrier may knit without affecting the operation the rear yarn carriers 7, 8, and thus different colored threads may be utilized to produce the different designs such as blocks, diamonds, or any other designs on the strip being knitted.

In order to effect the relative movement of the yarn carrier stoppers 32, 33, through the connecting rods 28, 29 and their respective blocks 25, 26, I have provided and mounted on the right and left hand screw 24, a pair of ratchets 35, 36, the teeth of said ratchets extending in reverse direction as shown by Figure 3 of the drawings.

Loosely connected to the sliding block 19 for vertical movement, there is provided a fork-shaped element 38, the upper and lower jaws 39, 40, of which are bent in reverse or opposite direction so that said jaws may engage the reversely angle teeth of the ratchets 35, 36, when said element 38 is lowered and raised. This movement will of course effect the direction of rotation of the right and left hand screw 24 and consequently the spreading or relative movement of the blocks 25, 26, so that when the jaw 39 is in engagement with one of the ratchets, the screw 24 will be rotated so as to spread the blocks 25, 26 and consequently space the yarn carrier stoppers 32, 33. On the other hand when the element 38 is raised so that the jaw 40 engages the adjacent ratchet, the screw 24 will be rotated in the opposite direction and thus the blocks 25, 26 will move toward each other and thus regulate the distance or number of needles engaged by the yarn carrier 34.

In order to effect the automatic, regular spacing of the blocks 25, 26, at predetermined intervals during the knitting operation, a ratchet 41 is loosely mounted on the shaft 24, the teeth of said last mentioned ratchet being engaged by the other end 42 of a lever 43 pivotally connected as at 44 to the fork-shaped lever 38. Upon each reciprocation therefor of the eccentric and the forward and rearward movement of the bar 15, the lever 43 will actuate the ratchet one tooth or the distance of one of the links of an endless chain 45, also loosely mounted on the ends of the shaft 24, above referred to. It will be seen that the endless chain 45 comprises a series of what I term low links 46, high links 47 and neutral links 48, which are adapted to engage an extension plate 49 attached to an angularly bent lever 50. The upper end of the lever is pivotally connected as at 51 to a stud and the lower end 52 of said lever carries a horizontally extending pin 53, which is adapted to engage beneath the fork element 38 as clearly shown by Figures 3 and 4 of the drawings. By reason of this construction, it will be seen that when the shaft 24 is actuated by the reciprocation of the sliding block 19 and the lever 43, as the high links travel and engage the extension plate 49, the lever 50 will be raised and consequently the pin 53 will raise the fork-shaped element 38 so that the jaw 40 will engage the ratchet 35, moving the screw shaft 24 in one direction. As this operation is effective, the blocks move to their extreme position until the low links pass beneath the extension plate 49 whereupon the fork-shaped element 38 lowers until the jaw 39 engages the contiguous ratchet and the screw 24 is moved in the opposite direction and the blocks travel toward each other, in each instance, the yarn carrier stoppers moving in the same relative direction as said block. When the neutral links pass beneath the extension plate 49, both jaws 39 and 40 are disengaged from the ratchet and consequently the blocks 25, 26, do not move. Thus the neutral links are introduced in the endless chain in order to permit of the spacing of the design, which in one form is shown as a diamond and indicated at numeral 55.

In the construction shown and above described, it will be easily understood that the size or width of the design, such as the diamond, will depend on the relative spacing of the yarn carrier stoppers and consequently if the number of links in the endless chain is increased or decreased, they will effect the relative movement of the blocks 25, 26, and necessarily the yarn carrier stoppers referred to. It will be further recognized that various designs may be made by alternating the high and low links with certain of the neutral links so that in each case, the blocks 25, 26, may be separated or moved relative to each other arbitrary distances, which affects the number of needles which cooperate with the yarn carrier 34.

In the type of machine shown, when the yarn carrier 7 moves backward and forward the rear yarn carrier 8 and the front yarn carrier 34 do not operate, at which interval the neutral links of the endless chain pass beneath the extension plate 49, however, when the yarn carrier 34 begins to operate the rear yarn carrier 8 operates back and forward and the yarn carrier 7 remains stationary, so that when two different kinds or color of yarn are wound through the yarn carriers 8 and 34, a double stitch is thus made and the particular design, such as the diamond 55, is set out somewhat in relief.

While I have shown the mechanism as attached to a flat knitting machine, it will

be readily recognized by those skilled in the art that the attachment is equally capable of being positioned on other types of machines to accomplish the same purposes.

While I have illustrated and described my invention with some degree of particularity, I realize that in practice various alterations therein may be made. I therefore reserve the right and privilege of changing the form of the details of construction or otherwise altering the arrangement of the correlated parts without departing from the spirit of the invention or the scope of the appended claims.

Having thus described my invention what I claim as new and desire to secure by United States Letters Patent is:—

1. In combination with the yarn carriers and operating mechanism of a knitting machine, yarn carrier stoppers, a pair of parallel connecting rods attached to each of the stoppers, a single right and left hand threaded rod having blocks movable thereon connected to each of the said rods, and means cooperating between the threaded rod and the operating mechanism to actuate the blocks and the connecting rods at predetermined intervals and space the yarn carrier stoppers during the operation of the machine.

2. In combination with the yarn carriers and operating mechanism of a knitting machine, yarn carrier stoppers, a pair of parallel connecting rods attached at one end to each of the stoppers, a threaded shaft having blocks movable thereon, attached to the opposite ends of the connecting rods, a forked member cooperating with the shaft and the operating mechanism to actuate the blocks and the connecting rods and yarn carrier stoppers at predetermined intervals and means to reverse the direction of actuation of said blocks during the operation of the machine.

3. In combination with the yarn carriers and operating mechanism of a knitting machine, yarn carrier stoppers, a pair of connecting elements attached to said stoppers, a threaded shaft having blocks mounted thereon attached to the opposite ends of the connecting elements, and means cooperating with the operating mechanism for reversing the direction of rotation of said shaft at predetermined intervals to relatively space the yarn carrier stoppers.

4. In combination with the yarn carriers and operating mechanism of a knitting machine, yarn carrier stoppers, a pair of connecting elements attached at one end to each of said stoppers, a freely rotatable threaded shaft having feed blocks mounted thereon, connected to the opposite ends of the connecting elements, means operable by the operating mechanism of the knitting machine for actuating said shaft and independent means for reversing the direction of rotation of the shaft at predetermined intervals.

5. In combination with the yarn carriers and operating mechanism of a knitting machine, yarn carrier stoppers, a pair of parallel connecting rods attached at their ends to said stoppers, a freely rotatable right and left hand threaded shaft, feed blocks mounted on the shaft and connected to the opposite ends of the rods, a sliding block operable by the operating mechanism of the machine, a loose ratchet and chain freely mounted on the shaft, a pair of reverse gears keyed to the said shaft, means operable by the block to engage either of the said gears and means cooperating with the loose chain to engage said reverse gears at predetermined intervals and space said blocks and the yarn carrier stoppers.

6. In combination with the yarn carriers and operating mechanism of a knitting machine, yarn carrier stoppers, connecting rods attached to said stoppers, a shaft having feed blocks thereon connected to the opposite ends of the rods, a sliding block operable by the operating mechanism reverse gears on the shaft, a single forked element for engaging either of said gears actuated by said block and means for raising and lowering said element at predetermined intervals to reverse the direction of rotation of said shaft.

7. In combination with the yarn carriers and operating mechanism of a knitting machine, yarn carrier stoppers, connecting rods attached to said stoppers, a shaft having feed blocks thereon movable in opposite directions connected to the opposite ends of the rods, a sliding block operable by the operating mechanism, a loose ratchet and chain on the shaft, reverse gears mounted on said shaft, a forked lever adapted to engage either of said gears, and means operable by the loose chain to raise and lower the forked lever to engage the gears at predetermined intervals and reverse the direction of rotation of the shaft and the feed blocks.

In testimony whereof I affix my signature.

JOHN MULLER. [L. S.]

549

Oct. 11, 1927. 1,644,688

E. OESTERREICH

KNITTING MACHINE

Filed Sept. 21, 1923 4 Sheets-Sheet 1

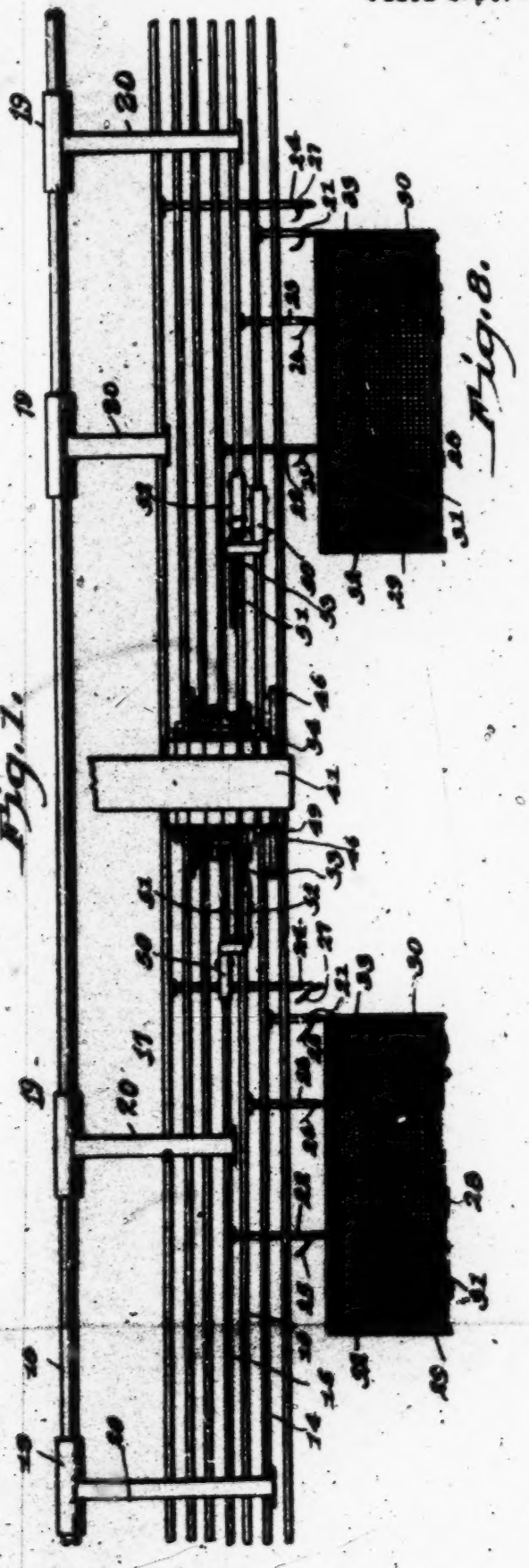

Fig. 1.

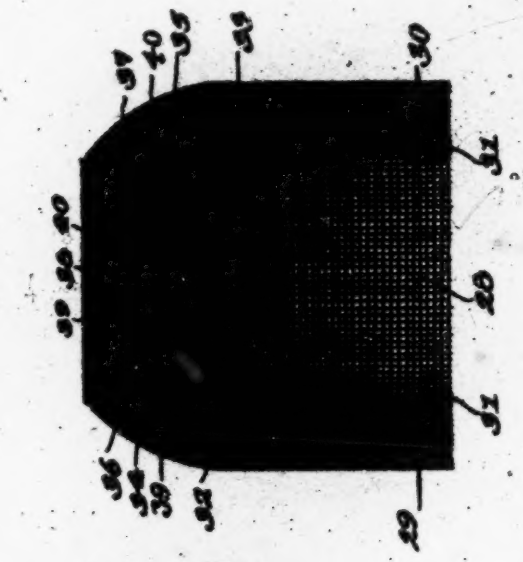

Fig. 8.

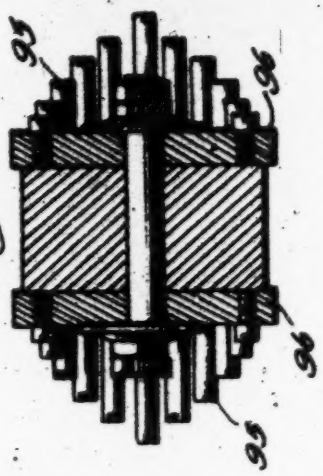

Fig. 10.

Fig. 11.

INVENTOR
Edward Oesterreich
BY
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Oct. 11, 1927. 1,644,688

E. OESTERREICH

KNITTING MACHINE

Filed Sept. 21, 1923 4 Sheets-Sheet 2

Fig. 3.

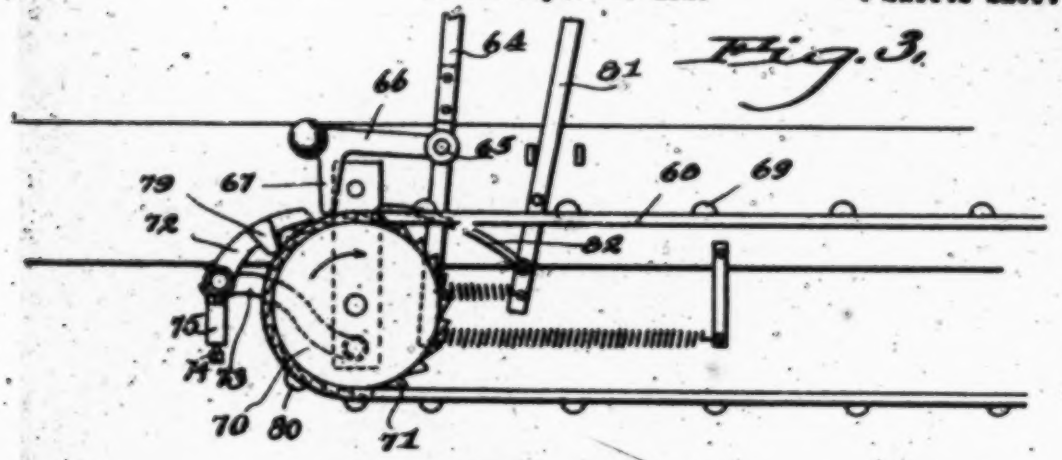

Fig. 4.

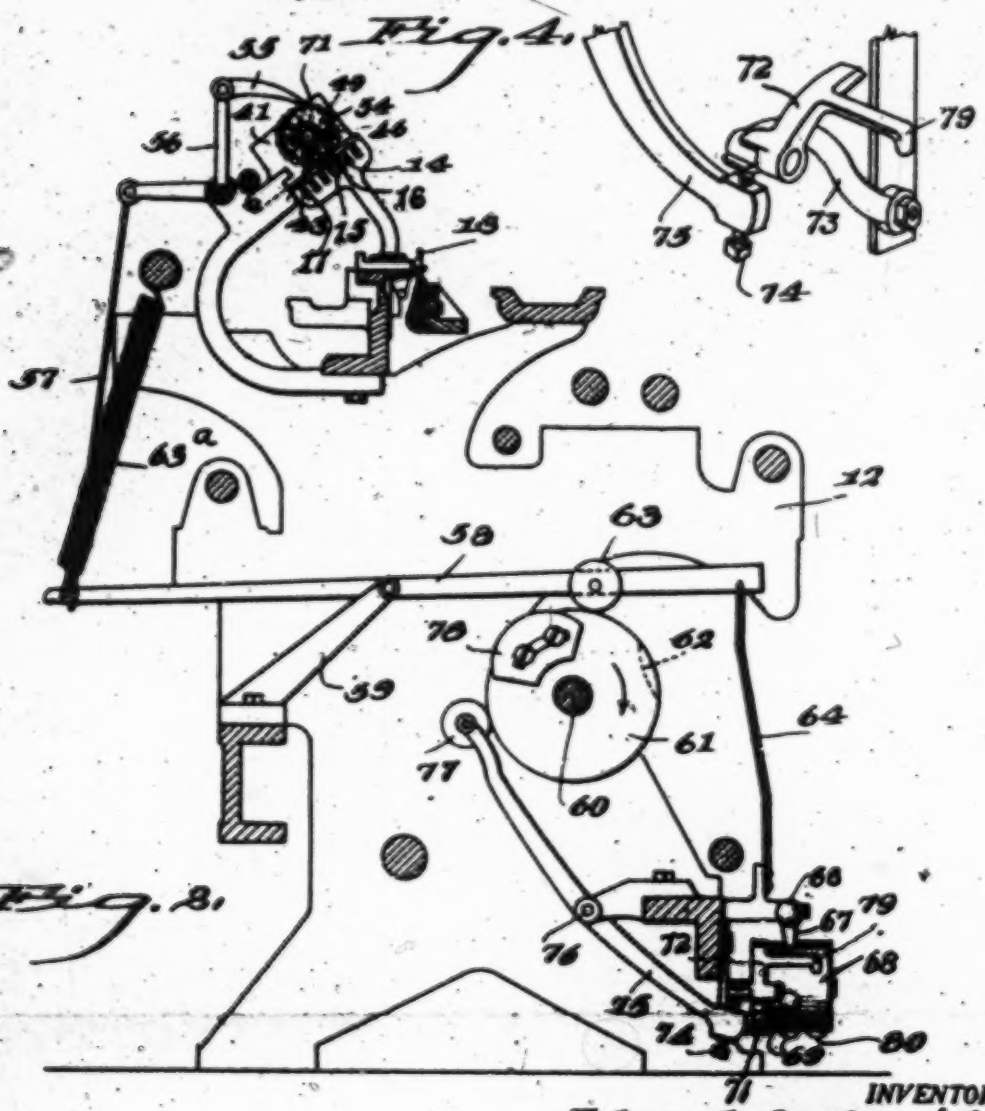

Fig. 2.

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551

Oct. 11, 1927. 1,644,688

E. OESTERREICH

KNITTING MACHINE

Filed Sept. 21, 1923 4 Sheets-Sheet 3

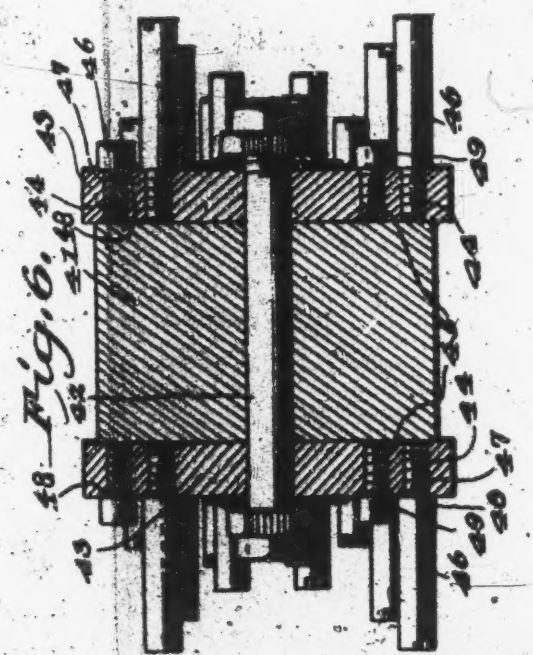

Fig. 6.

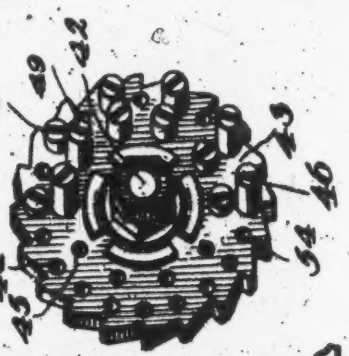

Fig. 7.

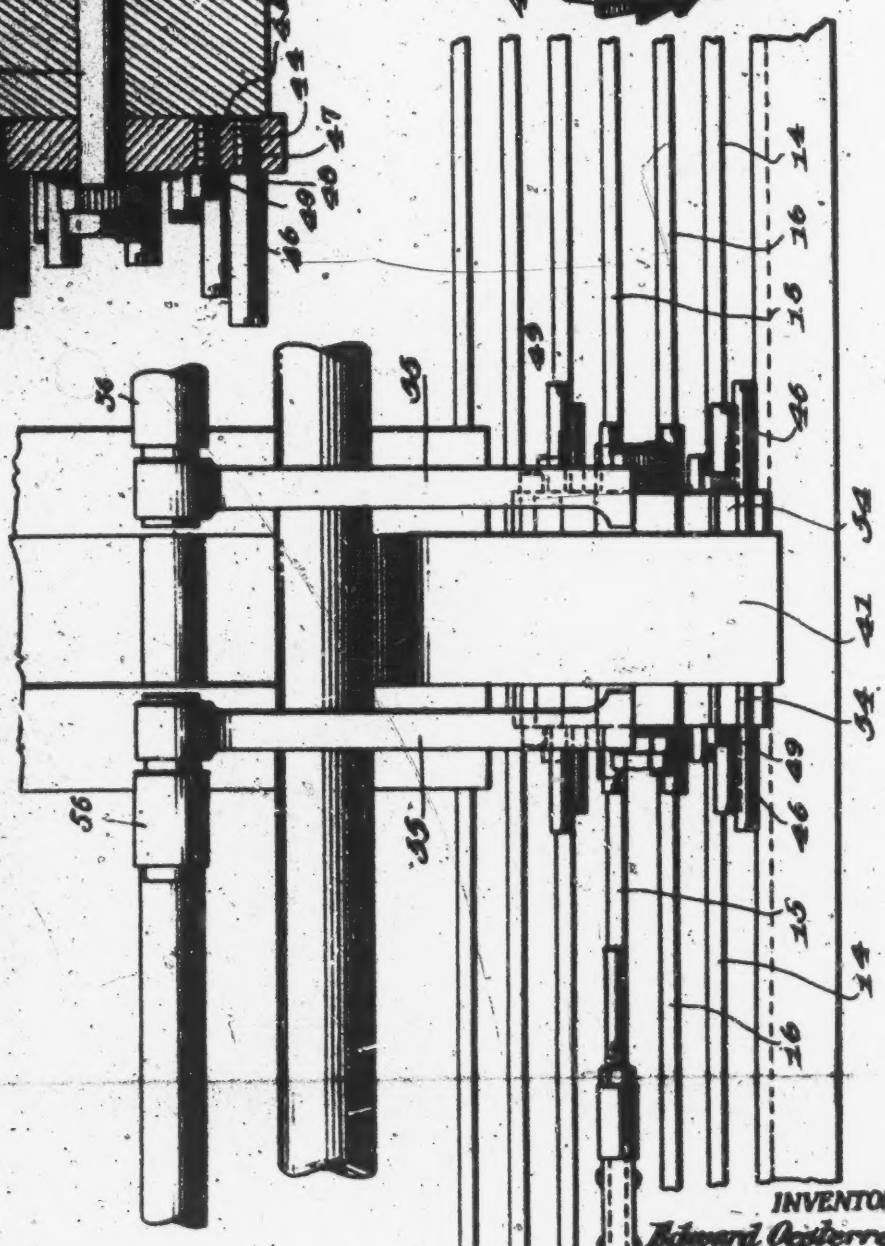

Fig. 5.

INVENTOR,
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ATTORNEY.

552

Oct. 11, 1927. 1,644,688

E. OESTERREICH

KNITTING MACHINE

Filed Sept. 21, 1923 4 Sheets-Sheet 4

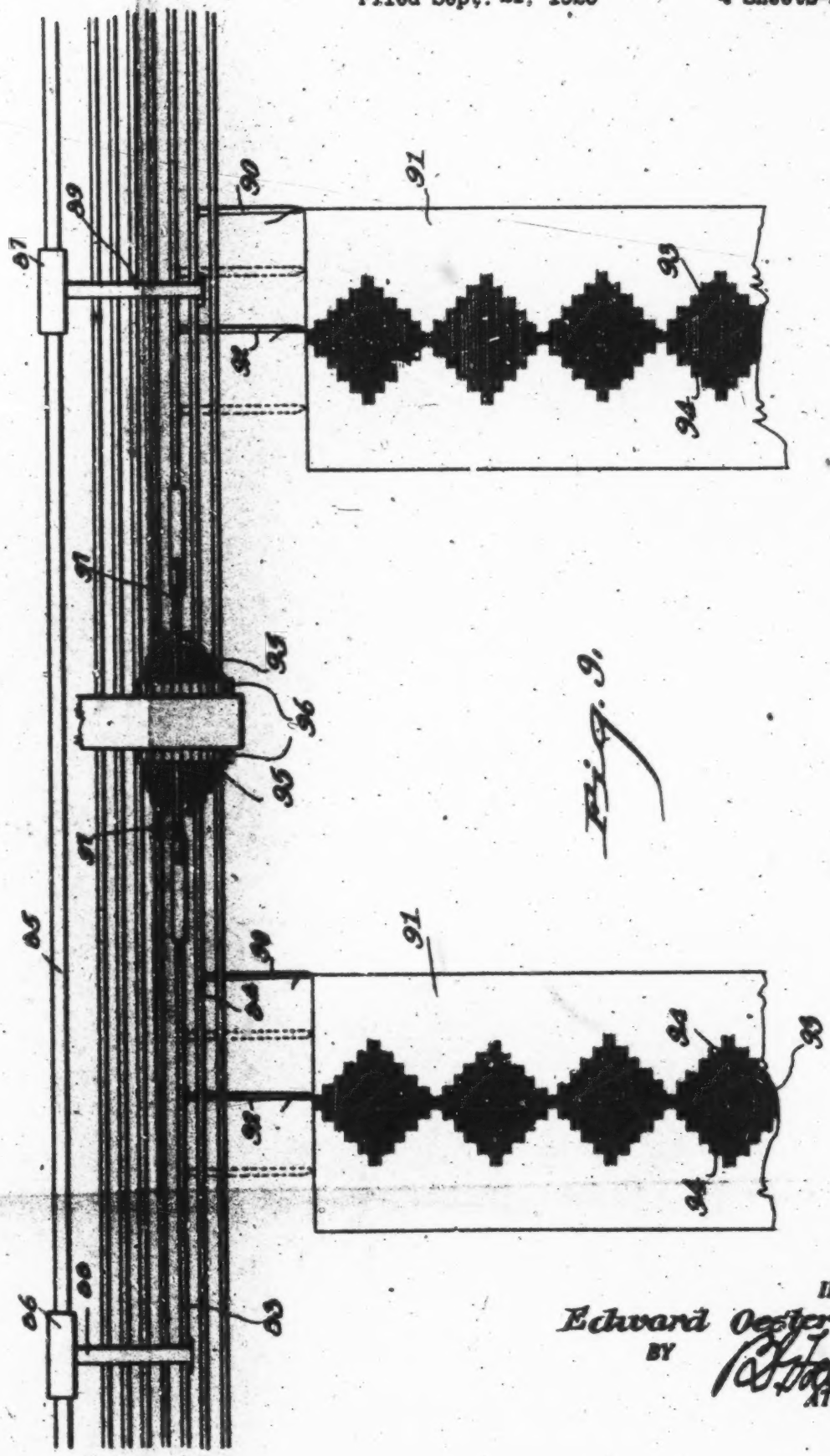

Fig. 9.

INVENTOR.
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ATTORNEY.

Patented Oct. 11, 1927. 1,644,688

UNITED STATES PATENT OFFICE.

EDWARD OESTERREICH, OF PHILADELPHIA, PENNSYLVANIA.

KNITTING MACHINE.

Application filed September 21, 1923. Serial No. 664,292.

The present invention relates more particularly to apparatus for knitting full fashioned hosiery and the like, and is peculiarly, though not exclusively, useful in the production of stockings having portions of light material, such as silk and other portions of heavier wear-resisting material as cotton.

One of the objects is to provide mechanism of a simple character, by which the light and heavy threads can be laid in the needles to produce effective reenforcements between the light and heavy portions and also artistic designs of a novel character. A further and important object is to provide mechanism that will withstand the necessary shocks and jars without distortion that would affect a fault or error in the design produced. A still further object is to provide mechanism that can be easily altered so that the design may be varied as desired.

In the accompanying drawings:—

Figure 1 is a plan view of a portion of a well-known type of knitting machine, somewhat diagrammatic in its character and provided with the novel construction.

Figure 2 is a cross sectional view taken substantially on the line 2—2 of Figure 1.

Figure 3 is a detail front elevation of the control mechanism.

Figure 4 is a detail perspective view of the operating pawl for said control mechanism.

Figure 5 is a plan view on an enlarged scale of the abutment members and their operating pawls.

Figure 6 is a detail longitudinal sectional view thereof.

Figure 7 is a perspective view of one of the abutment carriers and the abutments thereon.

Figure 8 is a plan view of a completed stocking toe blank.

Figure 9 is a plan view of a modified form of construction, showing the production of a spliced design in the legs of stockings.

Figure 10 is a longitudinal sectional view through the abutment structure shown in Figure 9.

Figure 11 is an end elevation of one of the abutment members and the abutments thereon, illustrated in Figure 10.

Portions of the frame of a well-known type of knitting machine are shown in Figure 2, and are designated 12. The machine includes the usual banks of needles, as indicated at 13. Over said banks are the usual longitudinally reciprocatory carrier rods. For the purpose of explaining this embodiment of the invention certain of these rods are designated respectively 14, 15, 16 and 17. The rods are moved back and forth by a longitudinally reciprocatory friction shaft 18 carrying friction boxes 19 having arms 20 that are engaged with the rods 14—17, to move the same.

The carrier rod 14 has mounted thereon a plurality of thread carriers 21. The carrier rod 15 is provided with thread carriers 22. The carrier rod 16 is provided with thread carriers 23 and the carrier rod 17 is provided with thread carriers 24.

Inasmuch as the disclosed arrangement is set up for the purpose of knitting stocking feet having cotton soles and silk upper portions, with a cotton toe cap, the thread carriers 21 and 22 are adapted to lay cotton threads 25 in the needles 13, the thread carriers 23 supply silk 26 to certain of the needles and the thread carriers 24 deliver a special heavier cotton thread 27 for the purpose of forming the toe cap. This set up moreover is particularly adapted to produce full fashioned stocking feet of the type wherein the silk is extended well down into the toe, and the corners formed by the cotton toe cap and cotton foot are reenforced by stepped splices of cotton and silk.

Referring therefore to Figure 8, showing the blank of such a foot structure, a silk top portion 28 is provided with marginal sole sections 29 and 30 of cotton on opposite sides of the top portion 28 and knitted thereinto. In other words the silk and cotton threads are overlapped or spliced at their juncture as shown at 31. As the toe is approached, the widths of the sole portions 29 and 30 are increased inwardly, and the width of the top portion 28 is correspondingly decreased. This is done by a series of successive steps 32 and 33, and during the formation of said steps the outer seams 34 and 35 only of the narrowing fingers 36 and 37 are formed. When the silk top portion 28 is terminated the toe cap 38 is started and the inner seams 39 and 40 of the narrowing fingers 36 and 37 are made. In the production of the steps 32 and 33 the cotton and silk extend across each successive set of steps, so that said steps are reenforced or in other word are formed by spliced or overlying cotton and silk threads. For the pro-

duction of these stocking feet the following mechanism is employed. A relatively heavy and rigid supporting arm 41 overlies the carrier rods 14—17, and extending therethrough is an axle 42 that projects beyond the opposite sides of the arm 41 and has journaled thereon abutment carriers in the form of disks 43. The disks are provided with an outer circular series of threaded openings 44 and an inner circular series of threaded openings 45. In the outer series is screwed a series of abutment pins 46 successively shorter in length and forming a stepped set of abutments. These pins preferably have reduced stems 47 that are screwed into the openings 44 and have shoulders 48 that bear against the outer faces of the disks. In the inner series of openings 45 are screwed a set of stepped abutments 49 corresponding to the outer series but arranged in reversed relation. In other words the longest pin 46 of the outer series is adjacent to the shortest pin 49 of the inner series.

The carrier rods 14 and 15, which operate the cotton thread carriers 21 and 22, have secured thereto brackets 50, in which are adjustably mounted stop pins 51, and the abutment pins 49 are so disposed that on the rotation of the disks 43 they will be brought into the paths of the stop pins 51 and thus determine the amount of movement allowed to the carrier rods 14 and 15, and consequently to the cotton carriers 21 and 22. Mounted on the silk carrier rod 16 are brackets 52 carrying adjustable stop pins 53. The inner set of stepped abutment pins 49 are adapted to correspondingly move into the path of the stop pins 46 and thus determine the traverse of the silk thread carriers 23.

The abutment carrier disks 43 are provided with peripheral ratchet teeth 54 operated on by pawls 55. These pawls 55 are actuated by duplicate mechanisms, and a disclosure and description of one of said mechanisms it is believed will be sufficient for both. The pawl 55 is mounted on the upstanding arm of a bell crank 56, the other arm of which is connected by a link 57 with a lever 58 that is fulcrumed between its ends on a bracket 59, mounted on the machine frame. A constantly rotating cam shaft 60 is provided with a cam 61 having a depressed portion 62, and a roller 63 journaled on the lever 58 rides on the periphery of the cam and is adapted to drop into the depressed portion 62. A spring 63a insures the swinging movement of the lever 58 when said roller is passed by the depressed portion 62, and as a consequence it will be evident that the abutment disk will be intermittently actuated.

The movement of the lever 58 is, however, controlled by a holding dog in the form of an arm 64 that is adapted to swing to a position under the free end of said arm 58 and support it so that it will not move when the depressed portion 62 of the cam 61 passes under the roller 63. This arm 64 as illustrated more particularly in Figures 2 and 3, is fulcrumed on the frame at 65, and has a right angular weighted arm 66 fixed thereto. The arm 64 has a depending finger 67 adapted to ride on the endless belt member 68, and this belt member is provided at intervals with buttons or projections 69 to pass under the finger 67, thereby raising the same, and causing the arm 64 to swing from beneath the lever 58.

The belt 68 passes around a pulley or roller 70 having ratchet teeth 71. Operating on said ratchet teeth is a pawl 72 carried on a swinging arm 73. The free end of this arm is supported on an adjusting screw 74 carried by a lever 75 as shown in Figures 2, 3 and 4. The lever 75 is fulcrumed between its ends, as shown at 76, and is provided at its upper end with a roller 77 that rides on the periphery of the cam wheel 61. This cam wheel is provided with a cam plate 78 adapted to ride against the roller 77, and thereby swing the lever 75. When it swings the arm 73 will be elevated and the pawl 72 engaging behind one of the ratchet teeth 71, will move the roller 70 and thereby the belt 68. The pawl 72 is furthermore provided with an offset finger 79 that normally rides on the belt 68 and said belt is provided at intervals with buttons or projections 80 which pass beneath the finger 79, thereby raising the pawl 72 out of coaction with the ratchet teeth and stopping the movement of the belt.

For the purpose of effecting a further movement of the belt to cause the buttons or projections 80 to pass the fingers 79 a hand lever 81 is fulcrumed on the frame, and is provided with a hook 82 that engages the ratchet teeth 71. By the operation of this lever the roller 70 can be moved far enough to disengage the button 80 from beneath the finger 79, thereby allowing the pawl 72 to again engage with the ratchet teeth 71.

The operation of the apparatus may be outlined as follows. Assuming the stocking foot, as illustrated in Figure 8, is to be knitted, the machine is set to knit the main body with the silk top portion 28 and cotton foot margins 29 and 30 in the usual manner, during which operation the rotary abutment carriers and their abutments are inactive, a button or projection 80 on the belt 68 being beneath the finger 79 and holding the pawl 72 out of engagement with the ratchet teeth 71, while the holding arm 64 is beneath the lever 58. When the point is reached where the steps 32 and 33 are begun, the operator swings the lever 81, thereby moving the roller 70 and the belt 68 a sufficient distance

to permit the pawl 72 to drop into engagement with the ratchet wheel 71, and at the same time a projection 69 moves to a position beneath the finger 67 of the arm 66, thereby swinging the holding arm 64 out of the path of the lever 58. As the cam 51 rotates and the depressed portion 93 passes beneath the roller 63, the lever 58 will be swung and through the link 57 and ball crank 56 the pawl 55 will be moved to turn the abutment disk. As both pawls 55 operate in unison both disks 43 will be actuated. As a consequence the cotton carriers 21 and 22 will be allowed movements equal to the widths of the sole portions 29 and 30, plus the first of the steps 32 and 33, while the silk carrier 23 will have a traverse from the outer edge of the first step on one side to the outer edge of the first step on the opposite side. The button 69 will by this time have passed beyond the finger 67, allowing the stop arm 64 to again swing beneath the lever 58, thereby stopping the rotation of the abutment carriers so that a predetermined number of courses will be formed, producing the first of the steps 32 and 33. The lever 75 is, however, continuously operating, thereby moving the belt 68 step by step, which will bring another button or projection 69 beneath the finger 67 and cause the stop arm 64 to again move from beneath the lever 58. When this takes place, said lever 58 will again operate, thereby turning the abutment disk another step and bringing another set of abutment pins into the paths of the stop pins 51 and 53. As a consequence a second set of steps will be produced, reducing the width of the silk top and increasing the widths of the sole portions. This is repeated until the toe cap is to be produced, whereupon the carrier rods 14, 15 and 16 are thrown out of operation and the carrier rod 17 is thrown into action by well known means, the carrier rod 17 being operated sufficiently to cause the carrier 24 to traverse both the cotton sole portions and the intermediate silk top, at the same time producing the narrowing fingers and completing the toe cap.

By this apparatus a stocking foot can be produced in which the silk top 28 is extended well into the toe and materially beyond the ordinary toe cap. At the same time the side margins are reenforced by spliced or doubled threads of cotton and silk and as these portions are subjected to the wear of the toe they are of wear-resisting material. The stocking is peculiarly desirable for wear with low slippers or dancing pumps, inasmuch as the cotton portions are not exposed.

That the apparatus is adapted for other uses of a generally analogous character, will be obvious by reference to Figure 9, which illustrates an arrangement of parts for producing a spliced ornamentation on the front of a stocking leg. In this structure a series or set of reciprocating carrier rods are disclosed, two of which are designated respectively 83 and 84. The rods are operated from a reciprocatory friction shaft 85 having friction boxes 86 and 87 with arms respectively designated 88 and 89 that actuate the rods 83 and 84. One of these rods, as 84, is provided with a plurality of thread carriers 90 that operate in the usual manner across the different banks of needles to produce the silk stocking leg blanks 91. The other rod 83 is provided with carriers 92 that are adapted to lay in splicing or overlying threads for the production of the ornamentations. Thus in Figure 9, this ornamentation consists of a succession of diamond figures 93 with stepped margins 94. The pattern is determined by stepped abutment pins 95 mounted on abutment carrier disks 96 and movable into the path of stops 97 mounted on the carrier rod 83. The means for operating these disks 96 is the same as that above described, and it is believed needs no repetition. Obviously by the utilization of the successive abutment pins 95 the traverse of the carrier rod 83 and the carriers 92 is determined and said carriers increase their amount of movement successively until the maximum width of the design 93 is produced and the traverse is then successively decreased in steps to the minimum width.

It will be obvious that the apparatus may be modified in sundry ways to produce different designs on different portions of the knitted fabric or body. Inasmuch as the controlling or pattern determining means is directly associated with the carrier rods, great accuracy in the design is secured and this accuracy is further made more certain by the particular mounting of the abutment disks, these, as shown in Figure 6, bearing flat against the opposite sides of the relatively heavy supporting arm 41 and the abutment pins having bearings both against the disk and preferably against the arm 41, also, so that there is no "give" when the pins are struck by the stop pins of the rods.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art, without further description, and it will be understood that various changes in the size, shape, proportion and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. In a knitting machine, the combination with a reciprocatory carrier rod and a thread carrier moved thereby of a stop fixed to the

carrier rod, an abutment carrier movable transversely of the stop, and a plurality of abutments mounted on the abutment carrier and comprising stems engaged in the abutment carrier and enlarged heads abutted against the abutment carrier and movable into the path of the stop.

2. In a knitting machine, the combination with a reciprocatory carrier rod and a thread carrier moved thereby, of a stop fixed to the carrier rod, a rigid support located at one side of the rod, and abutment carrier movably mounted on the support against the side thereof in opposition to the stop, and a plurality of abutments comprising stems engaged in the abutment carrier and heads that are against the outer face of the carrier and movable with said carrier into the path of the stop.

3. In a knitting machine, the combination with a reciprocatory carrier rod and a thread carrier moved thereby, of a stop fixed to the carrier rod, a rigid support located at one side of the rod, an abutment carrier rotatably mounted on the support against the side thereof in opposition to the stop, and backed by said stop, and a plurality of abutments comprising stems engaged in the abutment carrier and heads that are against the outer face of the abutment carrier and movable upon the rotation of said carrier into the path of the stop.

4. In a knitting machine, the combination with a carrier rod and a thread carrier movable therewith, of a stop for the carrier rod, a plurality of abutments movable into and out of the path of the stop, means for moving the abutments, including a lever and a cam that engages the lever to operate it, a holding dog movable into and out of engagement with the lever to hold said lever out of coacting relation to the cam, an endless belt having means that periodically operates the dog, ratchet mechanism for operating the belt, including a lever actuated by the cam, and means on said belt for throwing the belt actuating mechanism out of action.

5. In a knitting machine, the combination with a plurality of reciprocatory carrier rods, and thread carriers moved thereby, of a rigid support located between the ends of the rods and at one side of the same, spaced rotary heads having their inner sides abutting against opposite sides of the support, abutments projecting from the outer sides of the heads, and stops fixed to the rods on opposite sides of the support and heads, said abutments being movable into the path of the stops on the rotation of the heads.

6. In a knitting machine, the combination with a plurality of reciprocatory carrier rods and thread carriers moved thereby, of a rigid supporting arm overhanging intermediate portions of the rods, heads journaled on opposite sides of the arm and backed thereby, abutments of different lengths projecting from the outer side faces of the heads, and stops fixed to the rods, said abutments being movable into and out of the paths of the stops on the rotation of the heads.

7. In a knitting machine, the combination with a carrier rod and a thread carrier movable therewith, of a stop fixed to the carrier rod, a plurality of abutments movable into and out of the path of the stop at respectively different points, an actuating lever for the abutments, a cam that operates on the lever to move it, and a holding dog movable into engagement with the lever to hold it in inactive relation to the cam.

8. In a knitting machine, the combination with a carrier rod and a thread carrier movable therewith, of a stop fixed to the carrier rod, a plurality of abutments movable into and out of the path of the stop at respectively different points, an actuating lever for the abutments, a cam that operates on the lever to move it, a holding dog movable into engagement with the lever to hold it in inactive relation to the cam, and automatic means for intermittently actuating the dog.

9. In a knitting machine, the combination with a carrier rod and a thread carrier movable therewith, of a stop fixed to the carrier rod, a plurality of abutments movable into and out of the path of the stop at respectively different points, an actuating lever for the abutments, a cam that operates on the lever to move it, a holding dog movable into engagement with the lever to hold it in inactive relation to the cam, and an endless belt having projections that intermittently operate the dog.

10. In a knitting machine, the combination with a carrier rod and a thread carrier movable therewith, of a stop fixed to the carrier rod, a plurality of abutments movable into and out of the path of the stop at respectively different points, an actuating lever for the abutments, a cam that operates on the lever to move it, a holding dog movable into engagement with the lever to hold it in inactive relation to the cam, an endless belt having projections that intermittently operate the dog, a pawl and ratchet for operating the belt, and means for periodically throwing the pawl out of action.

11. In a knitting machine, the combination with a plurality of longitudinally reciprocatory carrier rods, of thread carriers operated by the rods, a rotatable abutment carrier having sets of abutments, said sets being located at different distances from its axis of rotation, means that respectively engage against the abutments for stopping the different carrier rods in different positions, and means for rotating the abutment carrier to successively present different abutments to the different stop means.

12. In a knitting machine, the combination with a plurality of longitudinally reciprocatory carrier rods having stops, of thread carriers operated by the rods, a rotatable abutment carrier having sets of abutments located at different distances from its axis of rotation, said stops extending longitudinally of the axis of the carrier and being of different lengths, and means for rotating the abutment carrier to simultaneously place abutments of different lengths in the paths of the stops of the different carrier rods.

13. In a knitting machine, the combination with a plurality of longitudinally reciprocatory carrier rods having stops and thread carriers, of a rotatable abutment carrier located transversely thereto, a plurality of sets of abutments projecting from a face of the carrier at different distances from its axis of rotation and of different lengths, the abutments of one set being arranged in reverse order to the other set, and means for intermittently rotating the abutment carrier.

In testimony whereof, I affix my signature.

EDWARD OESTERREICH.

559

(No Model.) 15 Sheets—Sheet 1.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

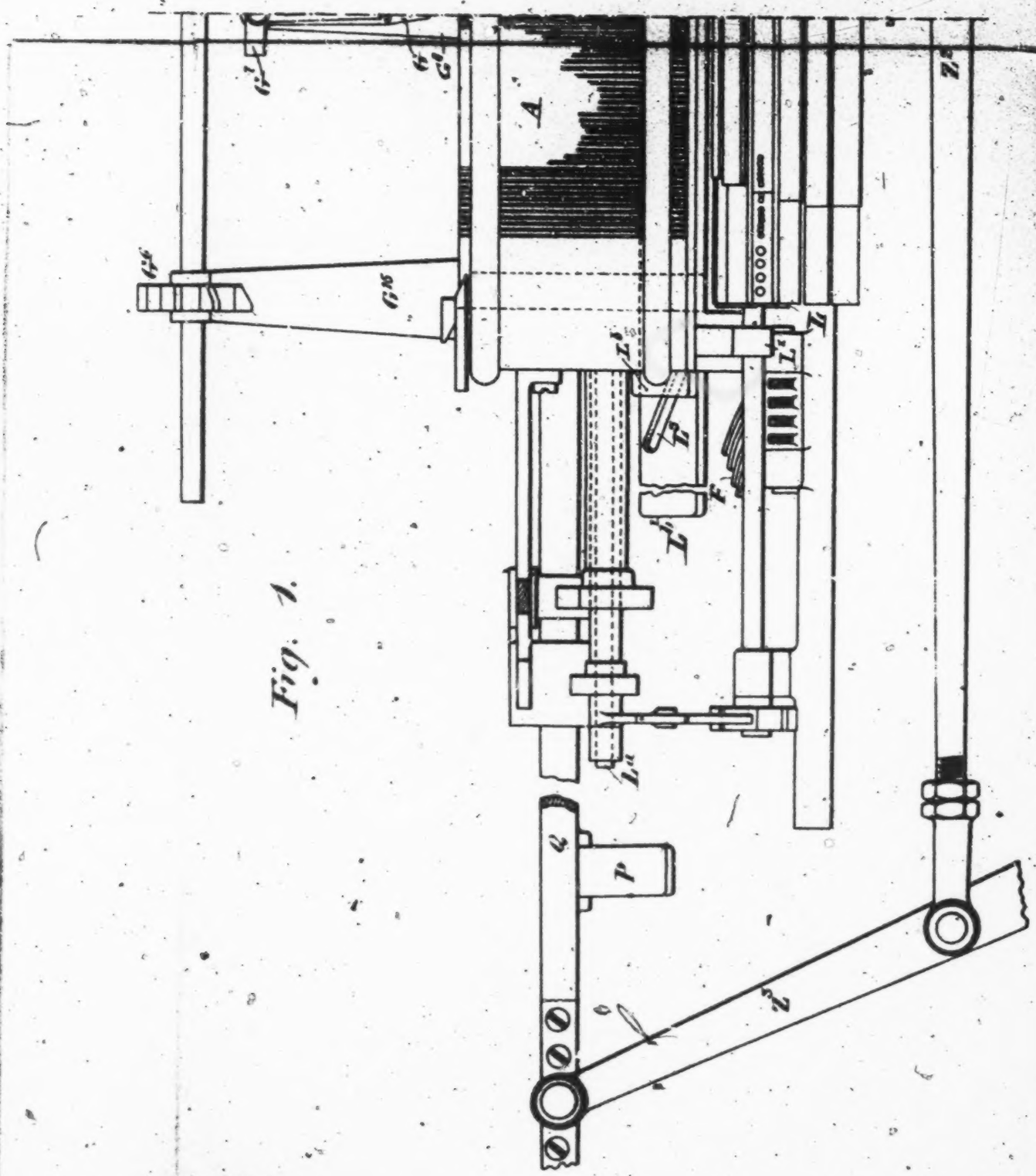


Fig. 1.

Witnesses.
George Gifford
Ballus D. Leary

Inventor.
William Tarlton Rowlett
By his attys.
Baldwin Davidson & Wright

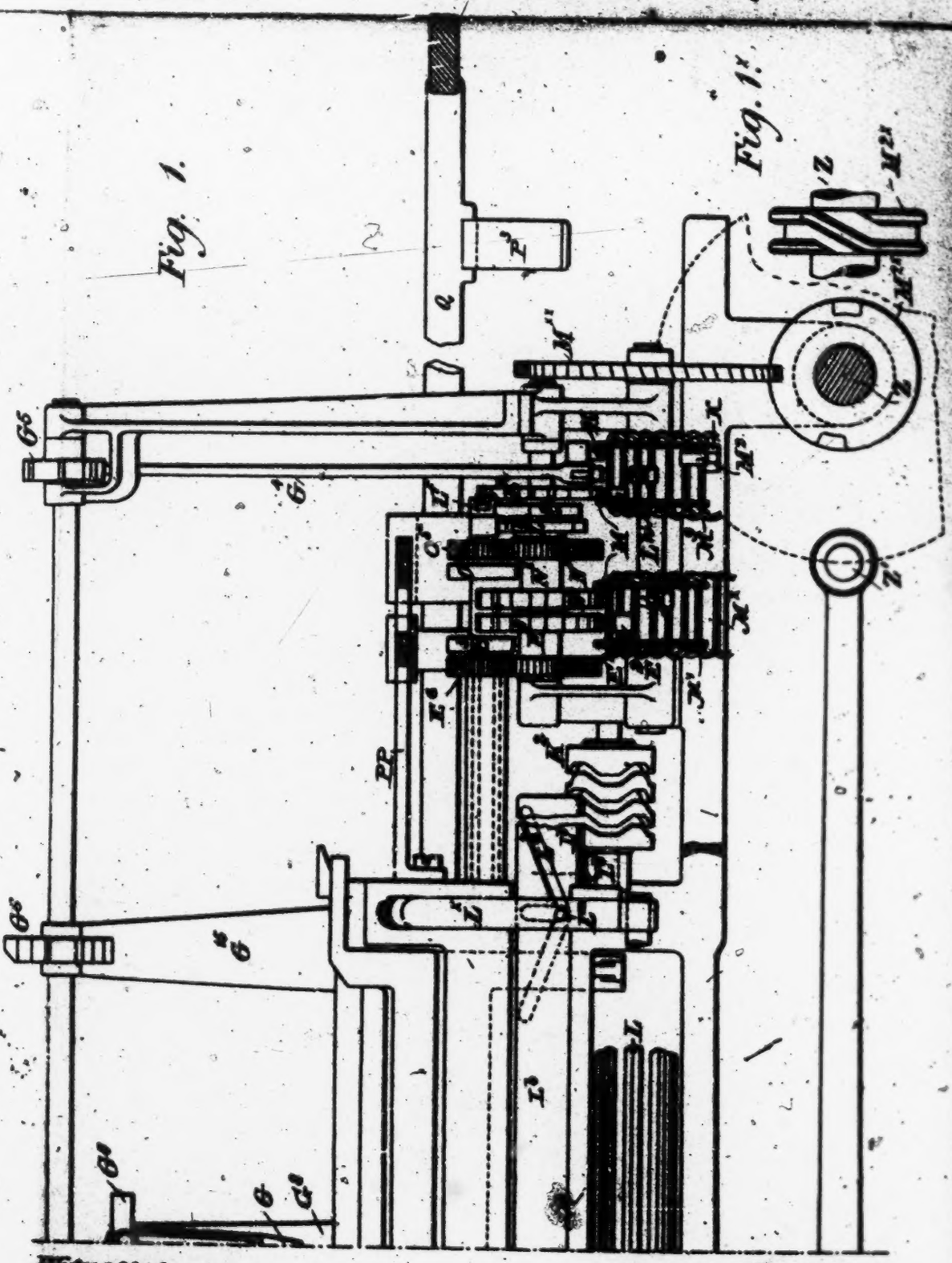
560

(No Model.) 15 Sheets—Sheet 2.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.



Witnesses,
George Dyer
Baltus DeLong.

Inventor.
William Luting Rowlett
by his Attys.
Baldwin Davidson & Wright

561

(No Model.) 15 Sheets—Sheet 3.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

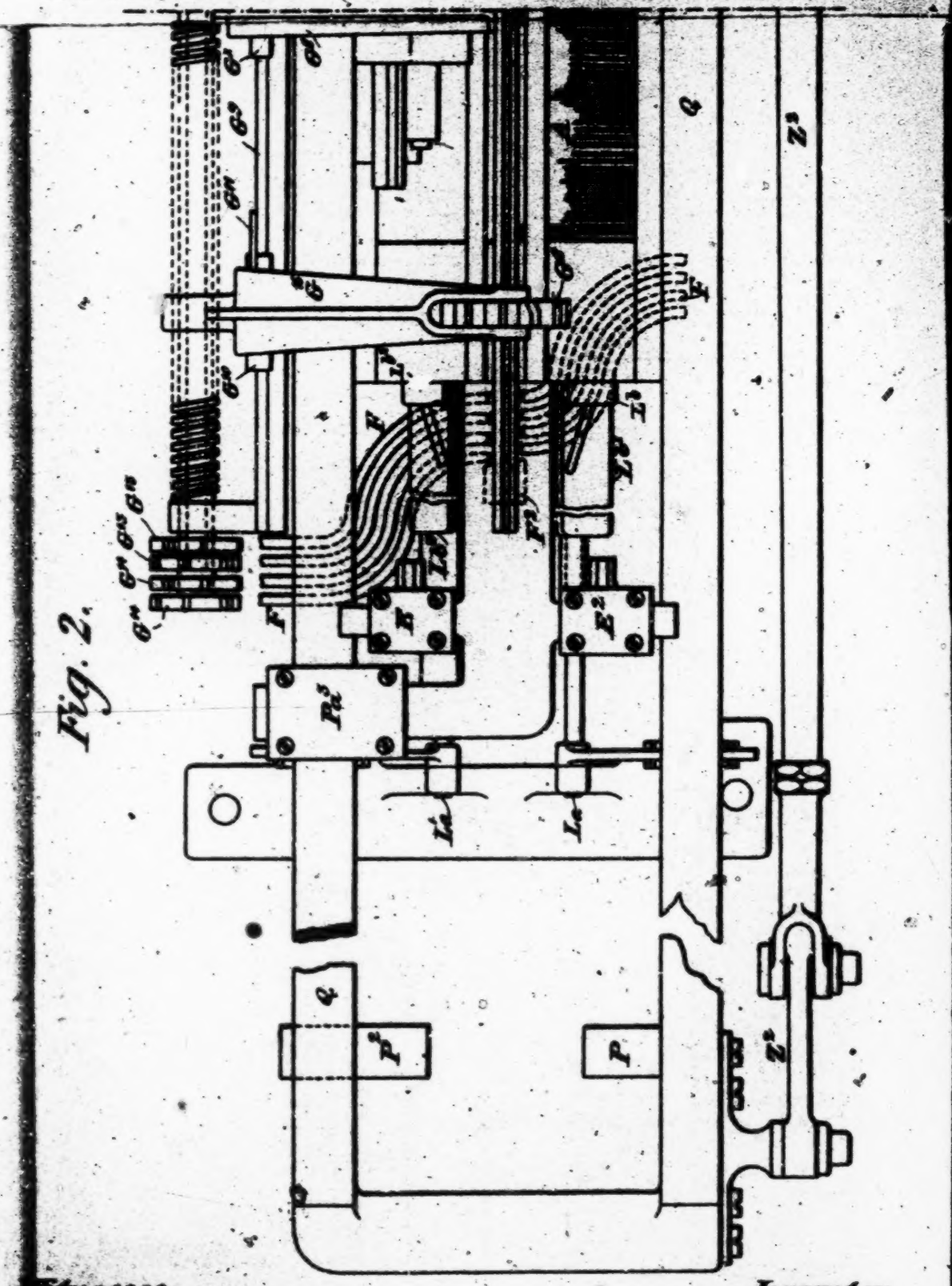


Fig. 2.

Witnesses
George E. Dixon
Walter D. Long.

Inventor.
William Tatum Rowlett
By his Attys.
Baldwin Hendrick & Wright

562

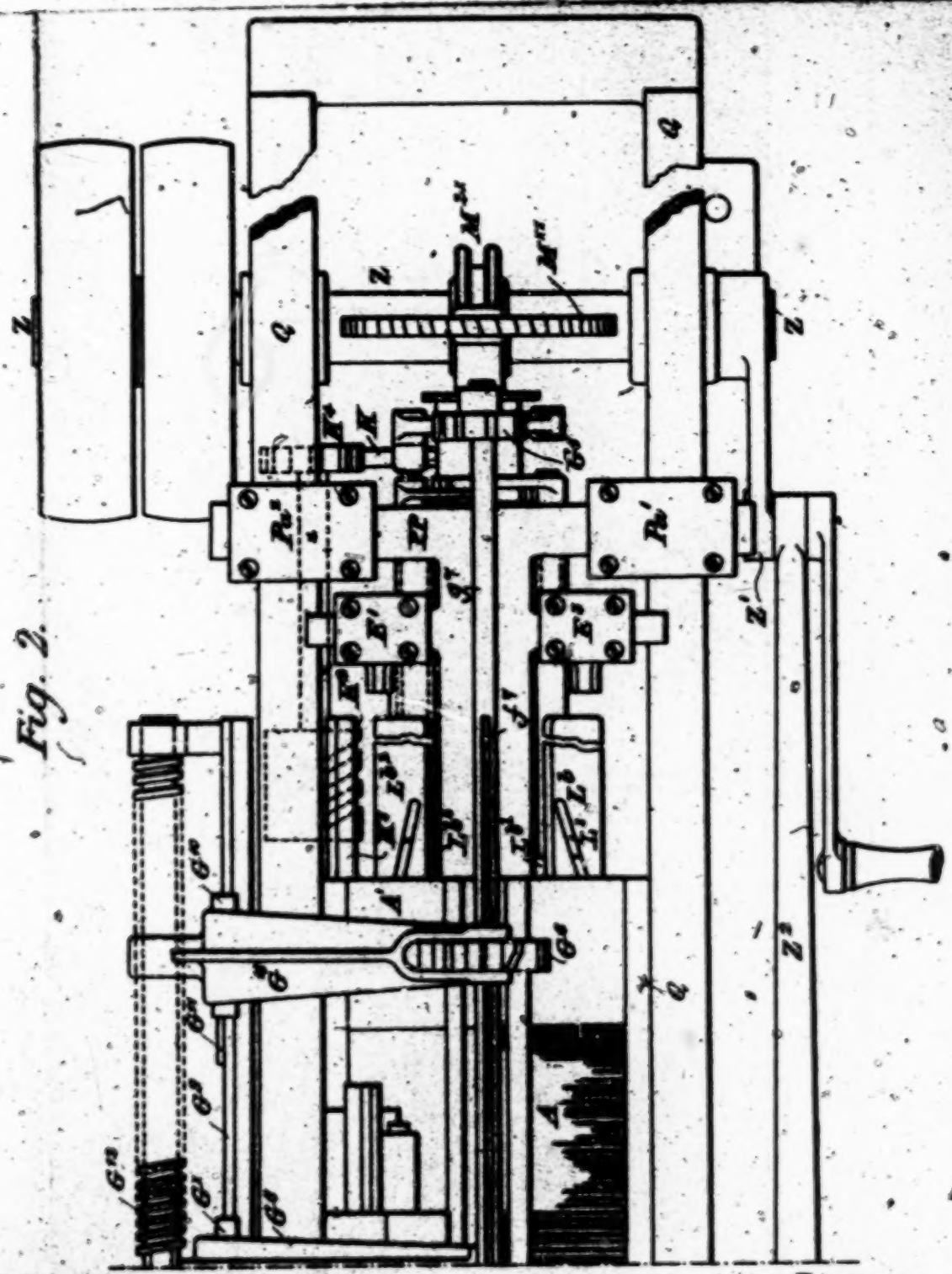
(No Model.) 15 Sheets—Sheet 4.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

Fig. 2.



Witnesses
George E. Dixon
Walter D. Long.

Inventor:
William Tertius Rowlett
By his Attys
Baldwin Bowden & Wright

563

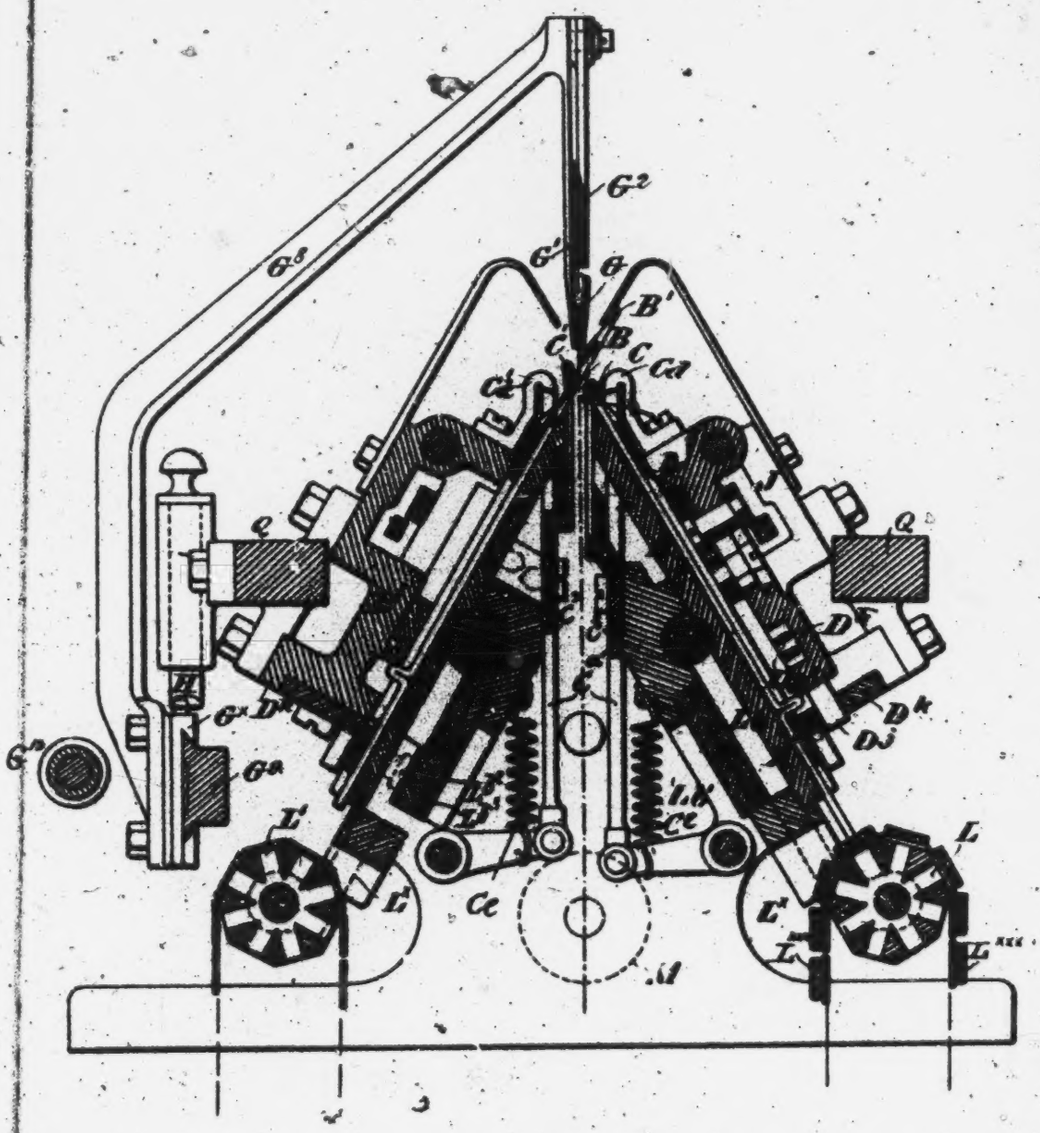
(No Model.) 15 Sheets—Sheet 5.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

Fig. 5.



Witnesses.

George D. Yarn.

Baltus DeLong.

Inventor:

William Sertius Rowlett,

By his Attys.

Baldwin Davidson & Wright

564

(No Model.) 15 Sheets—Sheet 6.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

Fig. 2ª.

Fig. 3ª.

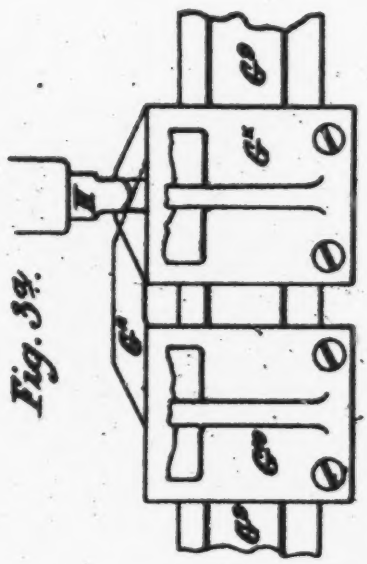


Fig. 3ª.

Witnesses.
A. W. Miller.
Walter D. Long

Inventor.
William T. Rowlett
By his Attorneys
Baldwin Davidson & Wright

565

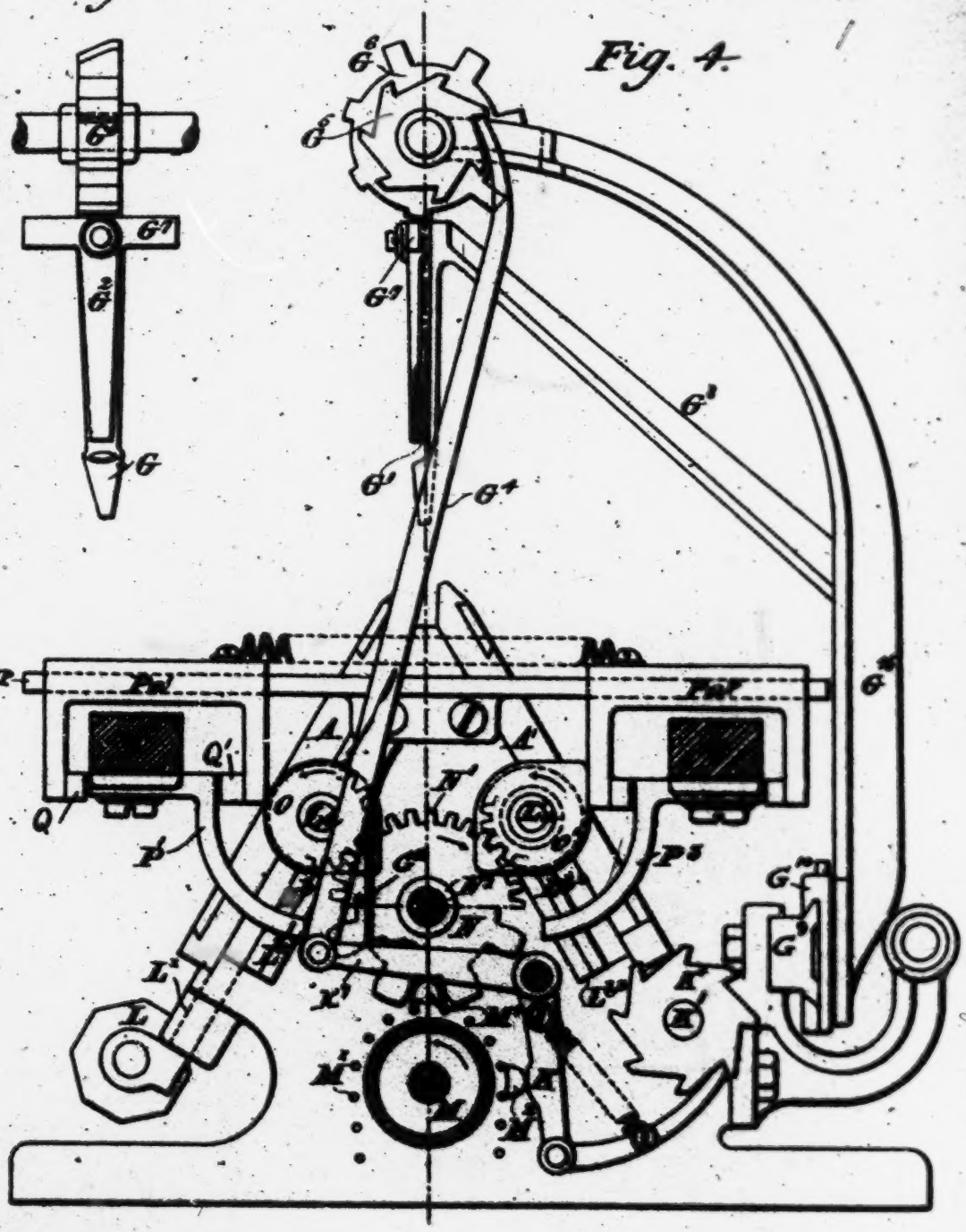
(No Model.) 15 Sheets—Sheet 7.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

Fig. 4.



Witnesses.
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566

(No Model.) 15 Sheets—Sheet 8.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

Fig. 4a.

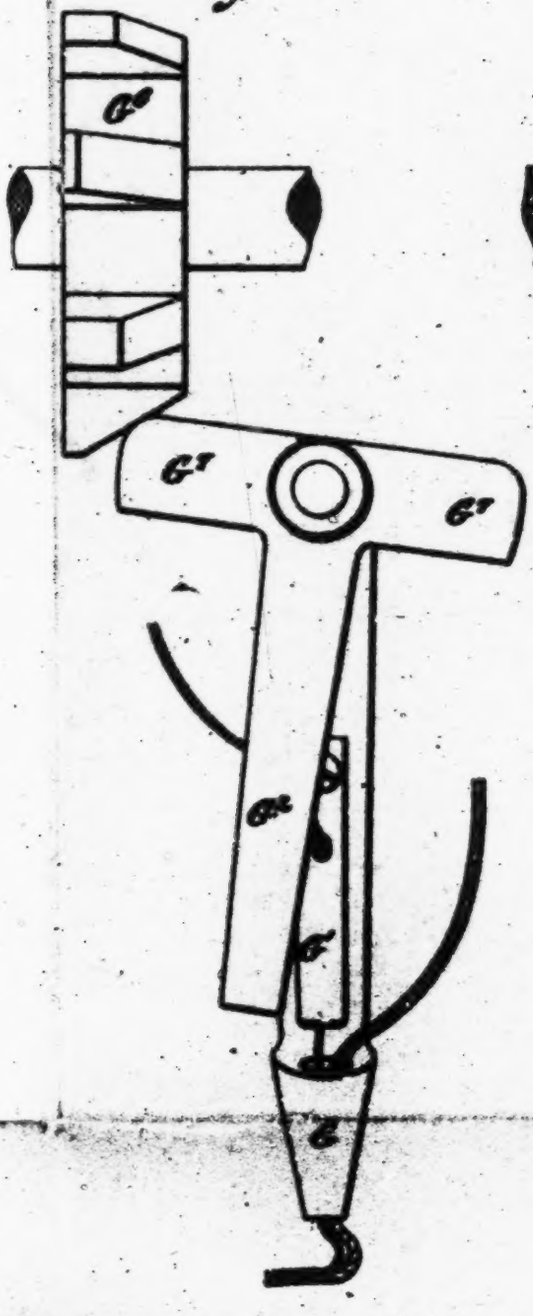
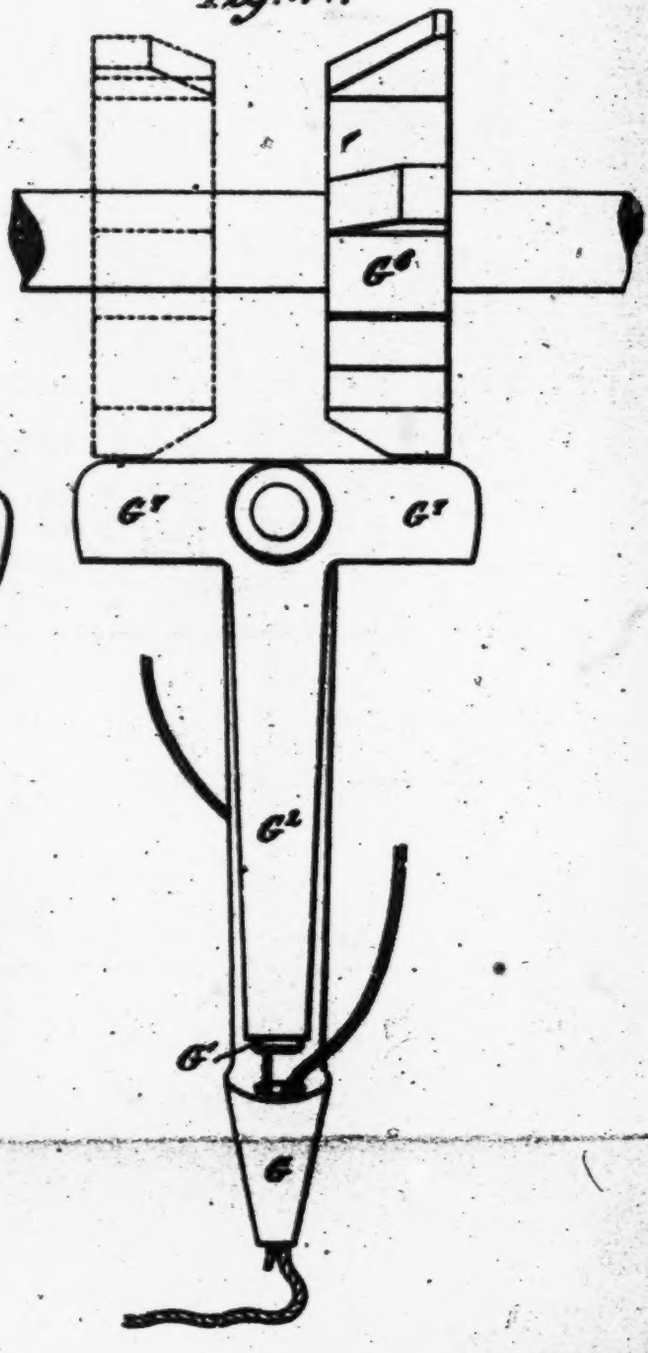


Fig. 4b.



Witnesses.
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(No Model.) 15 Sheets—Sheet 9.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

Fig. 4c.

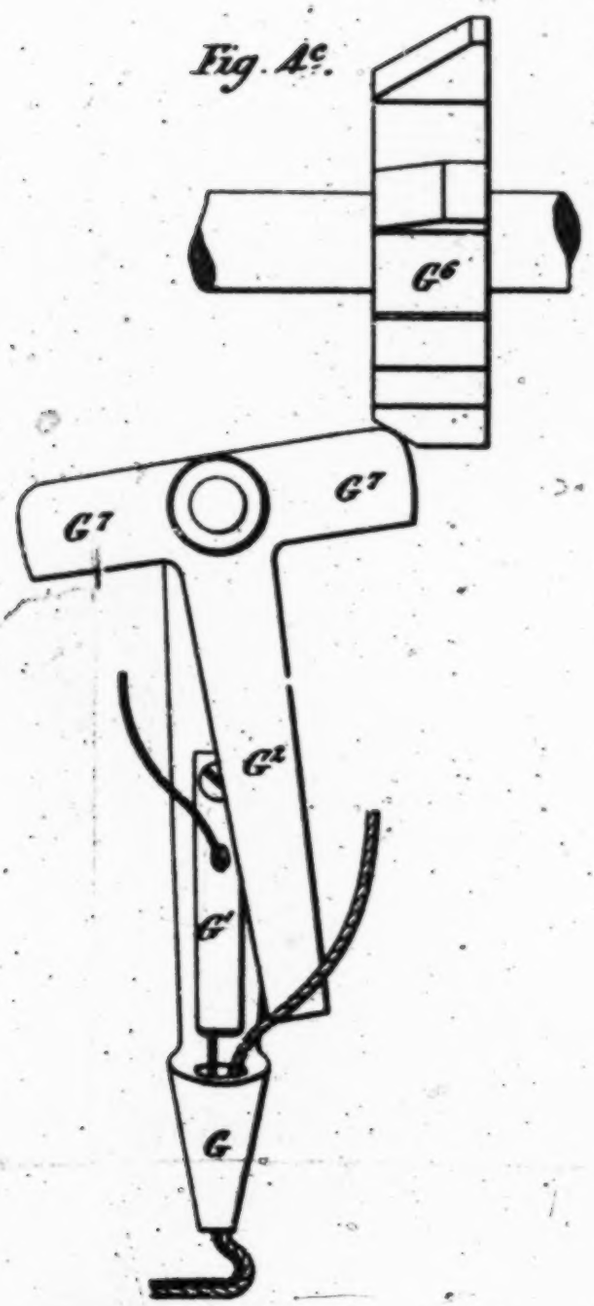
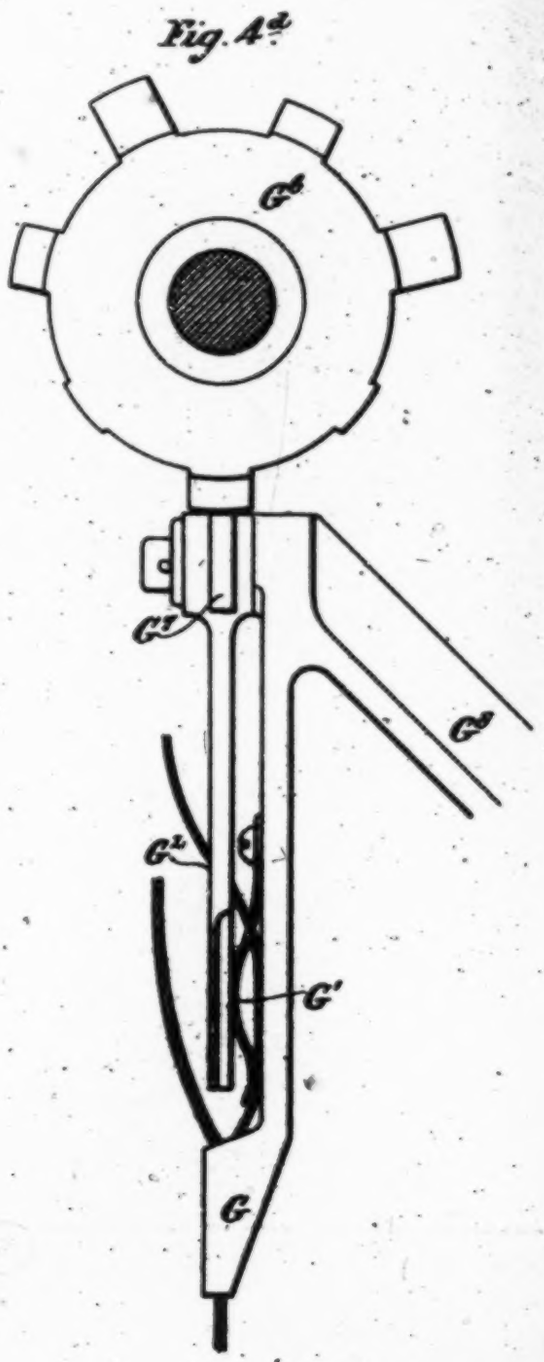


Fig. 4d.



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(No Model.) 15 Sheets—Sheet 10.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

Fig. 5ˣ.

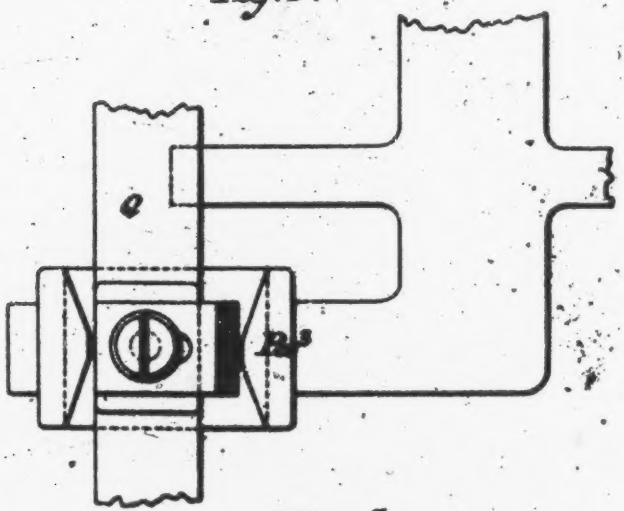
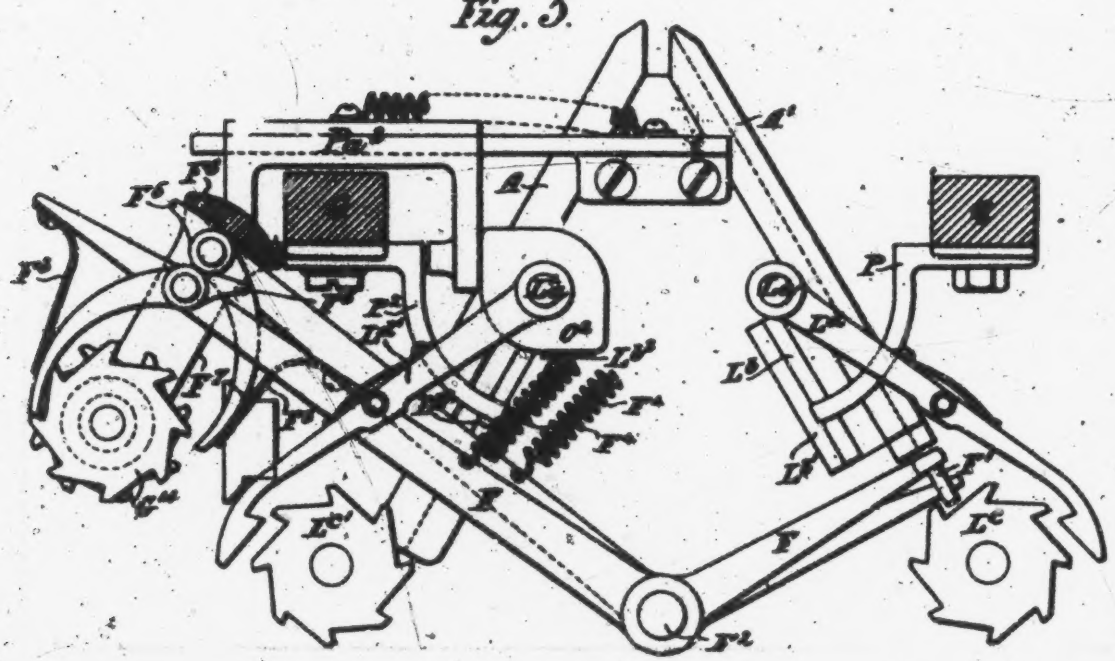


Fig. 5.



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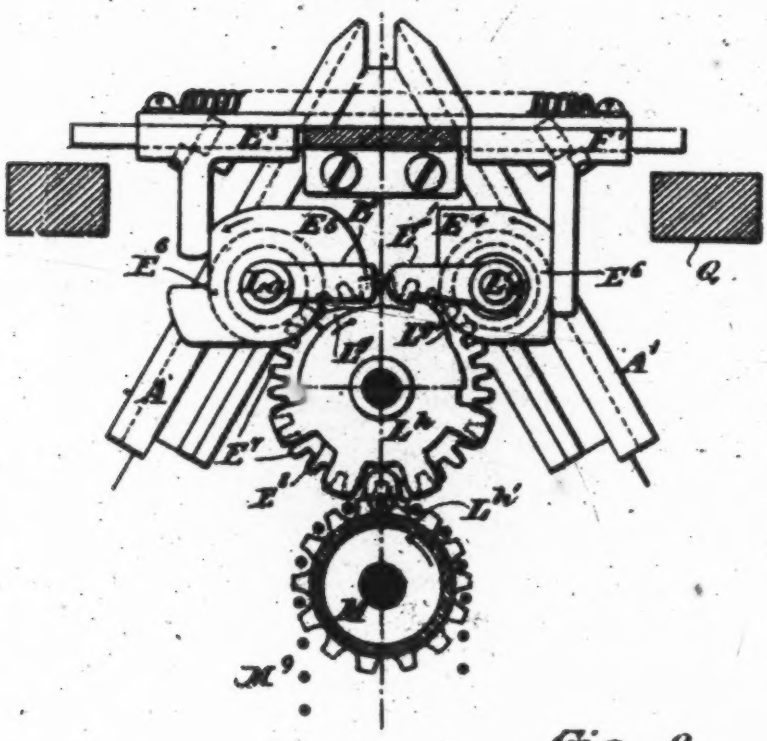
(No Model.) 15 Sheets—Sheet 11.

W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

Fig. 6.



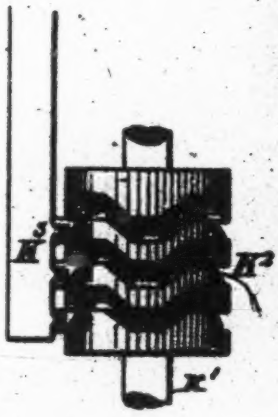


Fig. 7.

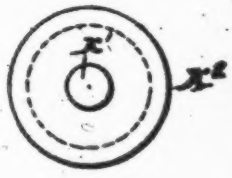
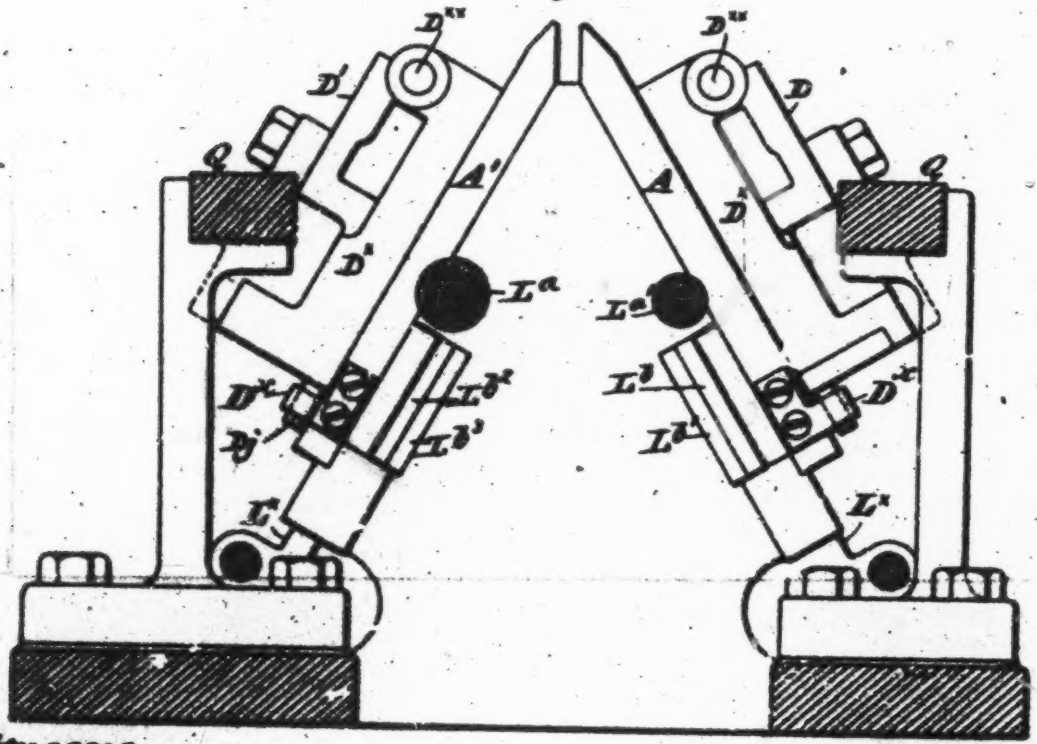


Fig. 8.



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W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.

Fig. 9.

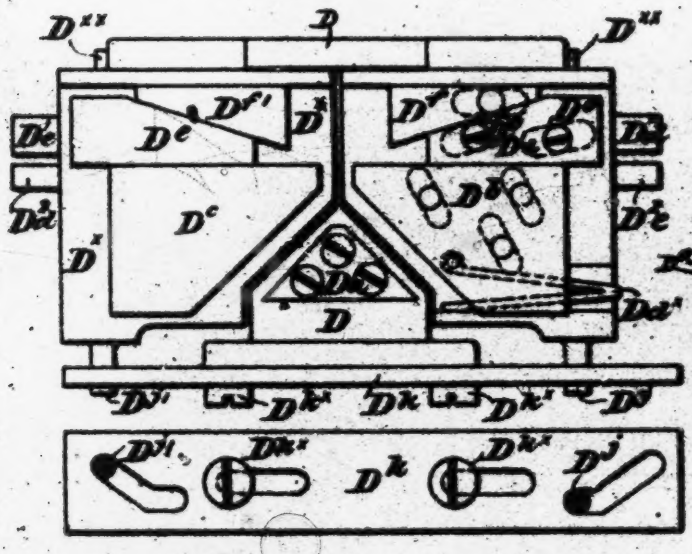


Fig. 13. Fig. 14.

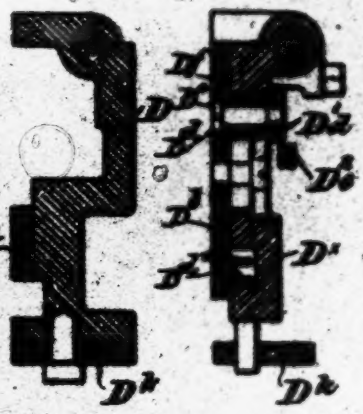


Fig. 10.

Fig. 11.

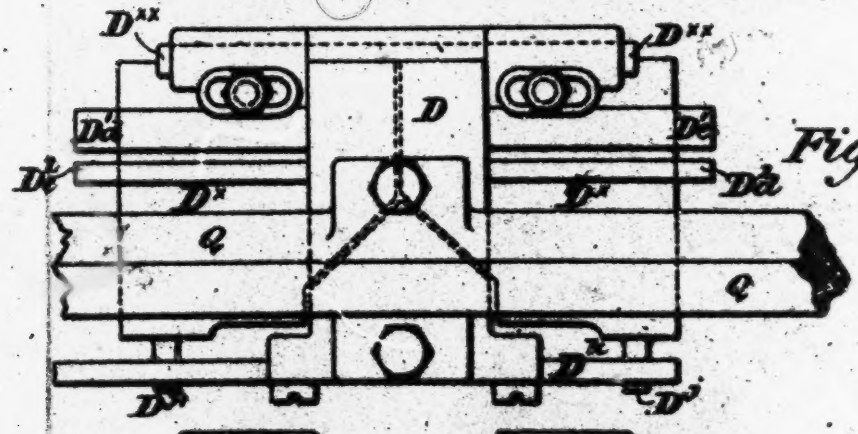
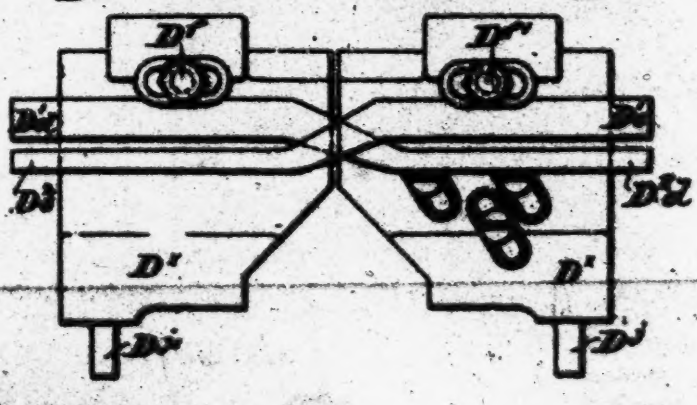


Fig. 12.



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W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

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Fig. 15.

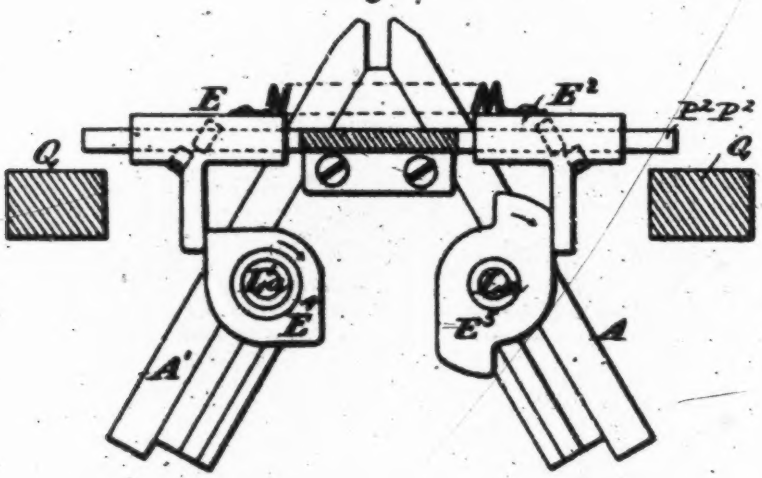
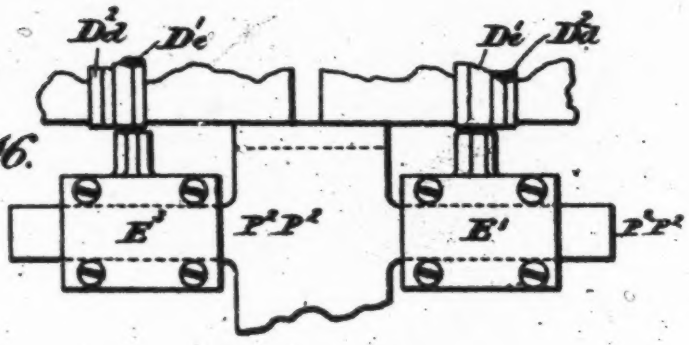


Fig. 16.



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572

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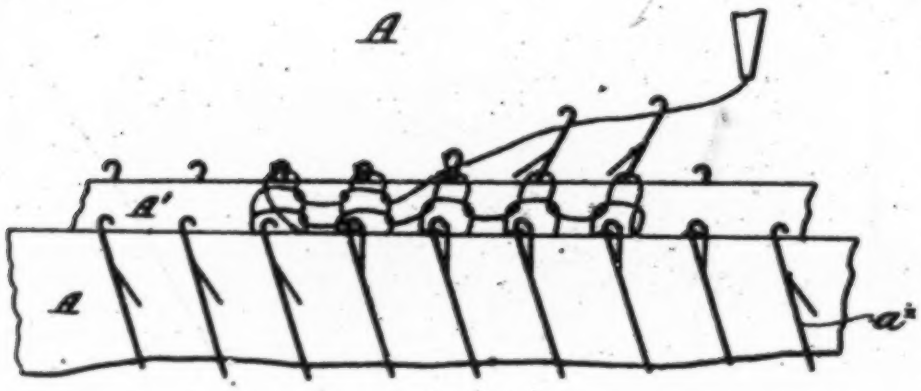
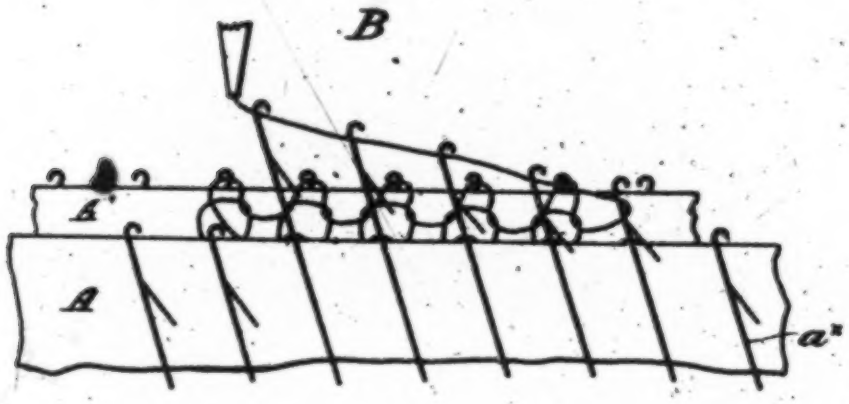
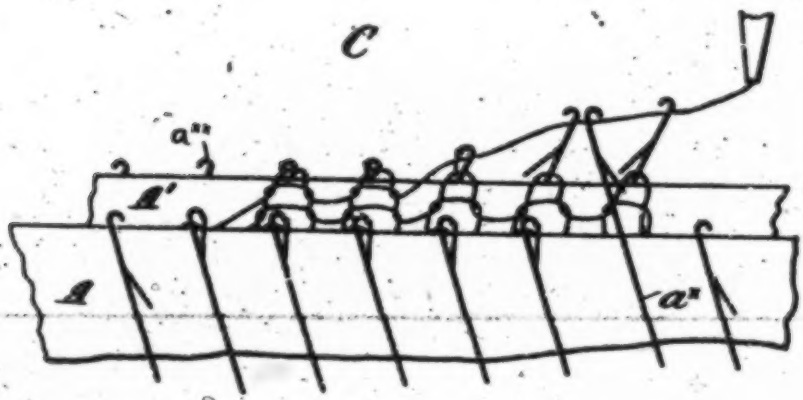
W. T. ROWLETT.

STRAIGHT KNITTING MACHINE.

No. 500,953. Patented July 4, 1893.







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(No Model.) 15 Sheets—Sheet 15.

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STRAIGHT KNITTING MACHINE.

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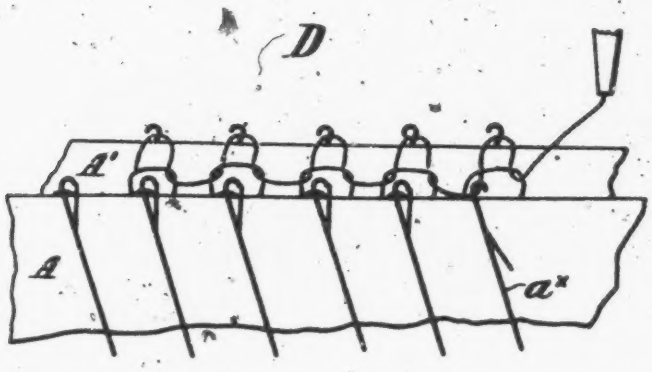

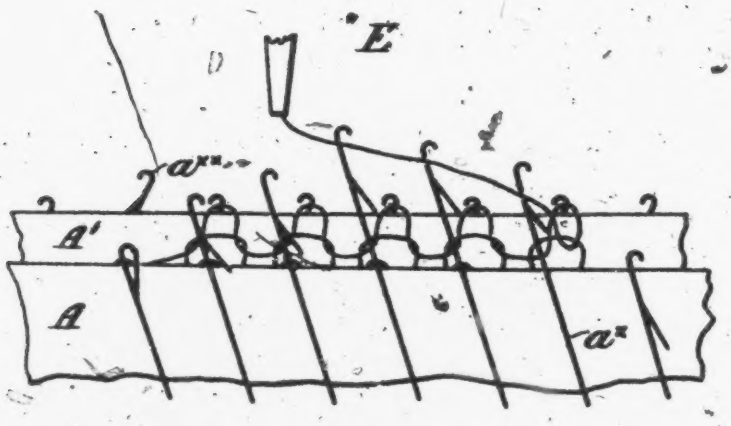

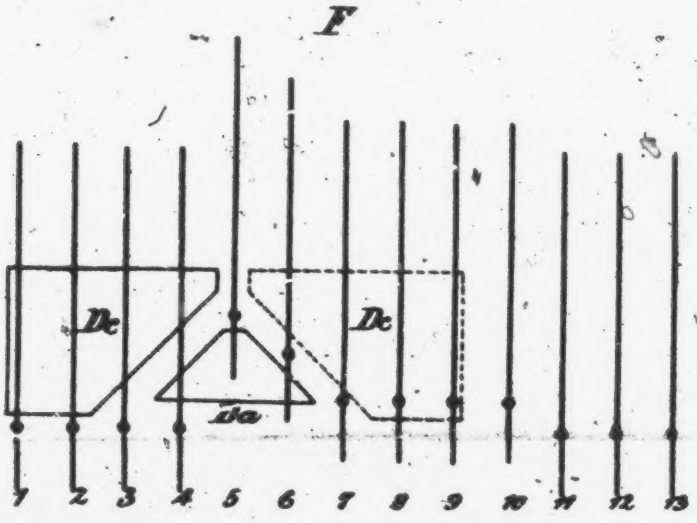

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148
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US 2
Part 2

UNITED STATES PATENT OFFICE.

WILLIAM TERTIUS ROWLETT, OF LEICESTER, ENGLAND.

STRAIGHT-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 500,958, dated July 4, 1893.

Application filed July 11, 1892. Serial No. 439,637. (No model.) Patented in England August 1, 1891, No. 13,126, and in France June 30, 1892, No. 222,711.

To all whom it may concern:

Be it known that I, WILLIAM TERTIUS ROWLETT, yarn merchant, a subject of the Queen of Great Britain, residing at 34 Newarke Street, Leicester, England, have invented certain new and useful Improvements in Straight-Knitting Machines, (for which I have received Letters Patent in Great Britain, No. 13,126, dated August 1, 1891, and in France, No. 222,711, dated June 30, 1892,) of which the following is a specification.

My invention relates to latch needle knitting machines formed with two parallel needle beds either straight or curved and adapted to produce tubular work as in the Lamb knitting machines. When making tubular work on such machines a course of work is first made along the needles of one bed and then with the same thread a course of work is produced along the needles of the other and so on, as is well understood. Machines of this kind have also before been constructed in such a manner that the down-throw cams used for lowering the needles bring the needles too low for them to be again raised by the up-throw cam, unless they have been previously raised a distance by the action of Jacquard cards brought against them. No fashionings could be produced automatically on such machines without small holes being left in the work wherever the widenings were made.

The main object of my invention is so to construct such machines that fashioned work may be automatically produced upon them without holes being left in the work at the points where the widenings are made. Whenever a widening is to be made, a new needle is brought up into working position at the end of one row or the other of needles previously in work. In order that a hole may not be produced in the work by the bringing in of this needle, I, according to my invention, cause the last sinker loop of the work on the opposite row of needles to be stretched or placed automatically on this needle before any work is made upon it. I do this by making one of the needle beds capable of being shifted endwise to and fro a short distance and by then causing the needle which is to be brought into work to come forward and take the loop at the proper time, as illustrated by the diagrams A, B, C. The action is illustrated in the diagram perspective views A, B, C, D, E, as seen from the front of the machine. Diagrams A and B show how tubular work is made in the ordinary way, a course of work being first produced upon one bed of needles A, and then with the same thread a course of work on the other bed of needles A′, and so on. Diagram A, shows work being produced upon a few of the back needles and B, shows work being produced on a few of the front needles. Diagrams C, D and E, show how a widening is made without allowing any hole to be formed in the work. Diagram C, shows the back bed A′ shogged to the right and the needle $a^{\times}$, which is to be brought into work, raised between the last two needles of the bed A′, which have work upon them. Diagram D shows how the needle $a^{\times}$ has thus been made to take the sinker loop between these last two needles. Diagram E shows the next course of work upon the front bed just being commenced. Diagram F shows how the cams raise and subsequently lower only such needles as have been previously raised a short distance by the action of the jacquard. The dots represent projections on the needle stems which the cams act upon. Da is the up-throw cam and Dc a down-throw cam. The needles 5 to 10 are shown to have been raised a short distance by the jacquard so that when the cams Da Dc travel to the right, they get farther raised by the up-throw cam Da and then subsequently lowered by the down-throw cam Dc to such a position that they cannot subsequently be acted on by the up-throw cam when it moves in the opposite direction unless they are first again slightly raised by the action of the jacquard.

In Figures 1 to 16 I have shown my invention applied to what is known as a Lamb machine which has two straight needle beds and is so constructed that either a piece of ribbed work or a tubular fabric of plain work can be produced upon it. Fig. 1 the right and left hand halves of which are shown on Sheets 1 and 2 is a side elevation partly in section of the machine. Fig. $1^{\times}$ is an edge view of cam $M^{1\times}$. Fig. 2 the two halves of which are shown on

Sheets 3 and 4 is a plan view: Fig. 2× is a longitudinal section of the screws G¹³, and the spindles which carry them. Fig. 3 is a transverse section on a larger scale of the needle beds and the cams and Jacquard barrels which operate the needle. Fig. 3ª is a side elevation of part of bar G⁹, and bolt H, as well as the slide G× and incline G″, and Fig. 3ᵇ is a side view of the inclines *Cd*. Fig. 4 is a right hand end view. Fig. 4× is a front elevation of some of the parts shown in Fig. 4. Figs. 4ª, 4ᵇ, 4ᶜ and 4ᵈ show the way in which the splicing thread is broken or allowed to pass into the work with the other thread. Fig. 5 is a transverse section showing the ratchet wheels and pawls by which the Jacquard barrels are turned and the ratchet wheel and pawls used for turning the screw shaft by which the position of the stops used for limiting the throw of the thread carrier is controlled. Fig. 5× is an under side view partly in section of a portion of what is shown in Fig. 5. Fig. 6 is a transverse section showing the parts used for putting the pawls which turn the Jacquard barrels in or out of action. Fig. 7 shows a top view and an end view of the cam used for shogging the movable needle bed to and fro. Fig. 8 is a cross section of the machine showing the form of the frame and the supports for the reciprocating frame by which the cam boxes are carried. Fig. 9 is an under side view of one of the sets of cams. Fig. 10 is a face view of one of the slides by which the downthrow cams are put in and out of action. Fig. 11 is a plan view of the cams and of a portion of the frame Q by which they are carried. Fig. 12 is a plan view of the two downthrow cams and of the two bars by which these cams are raised and lowered to produce slack and tight courses. Figs. 13 and 14 are vertical sections of what is shown in Fig. 9. Fig. 15 is a transverse section showing control cams and sliding stops at the left hand end of machine for controlling the stiffening of the work. Fig. 16 is a plan of part of the same.

In Figs. 1 to 16, Z is the main driving shaft which by crank pin Z′ connecting rod Z² and lever Z³ whose fulcrum pin can rise and fall gives a to and fro horizontal motion to a horizontal frame Q.

A is the front needle bed and A′ the back needle bed which is capable of being shogged endwise.

B are the needles of the front bed and B′ the needles of the back bed.

C are the web holders of the front bed and C′ the web holders of the back bed.

D is a plate carrying the cams of the front bed and D′ a plate carrying the cams of the back bed. These are bolted to short arms that stand out from the opposite side bars of the frame Q.

All variations of the letter D refer to various working parts of the cams.

G is the thread carrier carried by a slide G× which can be slid to and fro along a fixed bar G⁹.

G′ is a spring carrying a splicing thread.

G⁴ is a lever for cutting off and releasing the splicing thread.

H is a spring actuated bolt carried by the frame Q. It is pressed downward by a spring so that its lower end may engage with projections which stand up from the slide G× and carry the slide along with it until the bolt is raised and put out of action by inclines G″ (see Figs. 2 and 3ª).

K K′ K² K³ are parts for shogging the back needle bed A′.

L is the Jacquard barrel working with the front bed and L′ the barrel working with the back bed. M denotes barrels with pattern chains for controlling the working of all the parts.

Various views of the cams used for raising and lowering the needles are shown at Figs. 9 to 14.

Da is the upthrow cam secured rigidly to the plate D which as before stated and as is shown at Figs. 8 and 11 is bolted to the frame Q.

D× D× are plates hinged by the joint pin D×× to the plate D one on either side of it. Each plate carries a downthrow cam one marked *Db* and the other marked *Dc*.

Dk is a bar which by screws *Dk*× is held to the end of the plate D the screws passing through slots so that the bar can be slid a distance endwise to and fro. In it are two slots inclined in opposite directions. Into one enters a pin *Dj* which projects out from one plate D× and into the other enters a pin *Dj*′ which projects out from the other plate. In this way when the bar is moved endwise one plate is raised and the downthrow cam carried by it put out of action while the other plate is lowered and the downthrow cam carried by it brought into action. This endwise to and fro motion is given to the bar *Dk* by fixed stops *Dx* (see Fig. 8 Sheet 8) against which the ends of the bar strike at the end of each movement of the main slide Q. In this way the downthrow or stitch cam which was in action when the slide Q was moving in one direction is put out of action before the slide commences to move in the opposite and the other downthrow cam is brought into acting position. As will be seen by Fig. 9 the downthrow cams extend downward some distance beyond the bottom of the upthrow cam so that when the needles have been lowered by either of the downthrow cams they cannot be caught by the upthrow cam without being previously raised a distance.

The raising of the needles into a position for them to be caught by the upthrow cams is effected by Jacquard cards supported on Jacquard barrels L, L′. If when a card is brought against the needles there are holes in it opposite to the ends of any of the needles then those needles remain unraised by the card and are not caught by the upthrow

cam but the others are raised to a sufficient height for the upthrow cam to act upon and further raise them.

The axes of the Jacquard barrels are supported by bars L^{x} which can be slid up and down in guide grooves formed in the fixed frame at the back of the needle beds. From the back of the bar projects a pin L^{xx}. See right hand half of Fig. 1. This enters slots L^{3} cut in two of the plates *Lb*, *Lb'*, Lb^{2}, and Lb^{3} there being two of these plates situated at the back of each needle bed. When one of the two plates is struck endwise in one direction the Jacquard barrel will be drawn upward toward the lower ends of the needle stems and when the plate moves in the opposite direction the barrel is moved away from them. Normally the Jacquard barrels are away from the needles and the portions of the slots in the bars *Lb*, *Lb'*, and Lb^{2} and Lb^{3} which are parallel with the bars L^{x} are then one over the other and the barrel can be raised to the needles by either bar being struck endwise.

To strike the bars endwise and raise and lower the Jacquard barrels, stops P P' P^{2} P^{3} on the sliding frame Q are used. When by the movement of the sliding frame Q, one of the stops is brought against one of the bars, the bar is moved endwise and the Jacquard barrel is raised. When the frame Q, is moved in the opposite direction, the Jacquard barrel is drawn back from the needles by its own weight and carries the bar back to its former position. One stop P is fixed to the frame Q as it is always required to be in action because when P moves toward the end of the bar *Lb'*, the next course of work to be made is always upon the front needles whatever part of a stocking is being made, whether the toe or heel or leg; the front Jacquard barrel, therefore must at this time always be raised against the front needles; the others can be slid inward or outward a short distance in guides on the frame so that they may either come against the ends of the bars *Lb*, Lb^{2}, or Lb^{3} or not come against them.

If tubular work is being made and the frame Q, is being moved in a direction to bring P against the bar *Lb'*, the front Jacquard barrel is raised and the next course is made along the front needles; during this next course P^{2} comes against Lb^{2}, and lifts the back Jacquard barrel and the next course is made along the back needles; the other stops P' P^{2} are kept out of action. When a widening is to be made, say when a course of work is about to be made on the front needles, not only is the front Jacquard barrel brought up to its needles, as above explained, but also the back Jacquard barrel by reason of one or other of the bars Lb^{2}, Lb^{3}, being then struck by one or other of the stops P^{2}, P^{3}. The Jacquard card then brought up to the back needles by the back barrel is so pierced that only the new needle which is to be brought into work is raised into position to be caught by the upthrow cam and consequently at the end of the course it is only this needle of the back needle bed which takes the thread laid on to the front needles. When work is to be made on the front bed of needles, only, as for example when making the heel, both of the stops P^{2}, P^{3} are kept out of action, so that the back Jacquard barrel remains down and out of action.

The movement of the stops P' P^{2} P^{3} is controlled by inclines on three slides *Pa'* Pa^{2} Pa^{3} which can be slid transversely of the machine along horizontal arms P P fixed to the frame of the machine. They can be slid upward by the action of cams O O' O^{2} and are drawn inward by the action of springs as shown in Figs. 4 and 5.

It will be seen that the cam O differs in shape from the cams O' O^{2}. This is so that when the two latter have thrown the stops Pa^{2}, Pa^{3}, out of work P and P' remain in position so as to actuate the jacquard of the front bed every time when making the heel. In this way each Jacquard barrel will be drawn up to the needles at each alternate endwise movement of the frame Q, while when making the heel the jacquard of the front bed will be drawn up to the needles at every movement. Each time that the Jacquard barrels recede from the needles they are turned a distance by pawls *Ld* *Ld'* acting on ratchet wheels *Lc* *Lc'* fixed on the axes of the barrels. If however the pawls be held up out of the way of the ratchet wheels then the barrels remain unturned.

In making a straight tube continuously of the same width as for the straight portions of a stocking it is obvious that the same cards on the jacquard may operate every time so as to bring the same number of needles into action. This is done by causing the pawls to be lifted out of action. The pawls are on the ends of spindles *La* *La'* passing through the spindles carrying the cams which control the stiffening of the work. At the other ends of the spindles are two arms *Lf* *Lf'* which are raised by the action of two cams *Lg* *Lg'* (see Fig. 6) turned by a large cog wheel *Lh* half of which is cut away to allow of the cams being shown. The cog wheel has a partial turn given to it at the proper time by studs *Lh'* on a pattern chain M^{3} carried by the barrel M. The pawls are put out of work by being raised by the action of springs or weights and when they are to be brought into work they are held down by the action of cams *Lg*, *Lg'*.

The cams O O' O^{2} have a quarter turn given to them at the proper times by the action of pins on a pattern chain in the following manner: On the shafts which carry the cams are pinions O^{5} which gear with a toothed wheel N' on a sleeve N^{x} on which is also a wheel N having larger teeth. In Fig. 4 half this wheel is cut away to show the toothed wheel N' behind it. M^{x} is an endless pattern chain passing around a barrel M to which a step by step revolving motion is given. M' is a stud on the

pattern chain. When the chain is moved and a stud M′ comes against one of the teeth of the wheel N it turns this wheel a distance of one tooth. The step by step revolving motion is given to the barrel M by a worm wheel M^{xx} on its axis having gearing with it a worm M^{3x} on the main driving shaft Z of the machine. The greater part of the worm thread is at right angles to the axis and gives no movement to the worm wheel but at two opposite points is sharply inclined to the axis as shown at Fig. 1^{x} so as when these portions engage with the worm wheel they give to it a quick partial turn.

In making the two first rib courses at the toe of the stocking and also on the side wherever a new needle is brought into work it is desirable to make the fabric stiffer. Provision is therefore made for automatically setting the downthrow or stitch cams higher or lower according to the length of loop that is to be drawn down by the needles. This is done in the following manner: The cam D*b* is pressed upward by a spring Dd^{x} against a wedge D*d* which itself rests against a fixed corresponding wedge D*f*. By moving the wedge D*d* toward the wedge D*f* the cam D*b* is set lower while by drawing it back it is allowed to be raised by the spring Dd^{x}.

To move the wedge D*d* to and fro it is connected by pins D^{o} with a bar marked at its two ends D′*d*, $D^{2}d$ at the back of the plate D^{x} so that when the bar D′*d*, $D^{2}d$, is moved endwise the wedge D*d* goes with it. Slots in the plate allow the pins D^{o} to move freely. The wedge D*c* is similarly secured to a bar marked D′*c*, $D^{2}c$ and the above arrangement is duplicated for the cam D*c* on the left hand side of Fig. 9. The spring and some of the other details are not shown on this side of the figure.

At each end of the machine are stops E E′ E^{2} E^{3} see Figs. 2, 15 and 16 having projecting pieces. A plan view of E′ E^{3} is shown in Fig. 16. When the main slide reaches the end of its throw say from left to right the projecting pieces on the stops E^{3} and E′ touch for example $D^{2}d$ and D′*d* respectively and change them from their previous positions if they were not already in the positions into which the stops would move them.

The stops are carried by slides which can be slid to and fro transversely of the machine along horizontal arms P^{2} P^{4} fixed to the frame of the machine. They can be slid outward by the action of cams E^{4} E^{5} and are drawn inward by the action of springs in a similar manner to the slides Pa′, Pa^{2}, Pa^{3}. The cams also have motion given to them from a shaft which has a step by step revolving motion transmitted to it at the proper time in the same way as described with respect to the cams O O. The cams E^{4} E^{5} are on hollow spindles which surround the spindles La, La′. They are turned at the proper time by pinions E^{2} (see right-hand half of Fig. 1), gearing into a toothed wheel E^{7}, on the axis of which is a wheel E^{8}, having larger teeth. On the pattern chain M^{x} are studs E^{9}. When by the movement of the endless chain one of these studs E^{9} engages with the teeth of the wheel E^{8} and gives a partial turn to this wheel a quarter turn is given to the cams E^{4}, E^{5}, and the down-throw cams are set to make either tighter or slacker courses according to the previous position of these cams.

In order to keep the work down while the needles are being pushed up by the jacquard, I have a row of hooks C and C′ (see Fig. 3) attached to each knocking over bar C^{2}. When the course is being made, these hooks are in the position shown at C′, so that the sinker loops lie over their stems. Before or just as the Jacquard barrels raise the needles the hooks C, C′, are lowered so as to hold the loops down while the needles are raised. They are lowered by inclines Cd or Cd′ (see Figs. 3 and 3^{b}), fixed on the cam plates D, D′. Toward the end of each course the inclines come above the ends of the rods Ca′, which stand up from the bars by which the hooks C C′ are carried and thereby lower and hold down the hooks. Afterward when the cam plates D, D′ are made to travel back in the opposite direction, the inclines are moved away from above the rods Ca′, and the hooks C, C^{c} are drawn upward by the action of springs Cs, (see Fig. 3). In the drawings, Fig. 3 both of the rods Ca′ are shown as being held down by the inclines Cd, Cd′, but one of the knocking over hooks is left up to illustrate its two positions.

The thread carrier G is carried by the arm G^{2} from a slide G^{x} which can be slidden along the fixed bar G^{3} by the bolt H which is held down by a spring. On the bar G^{3} are also two slides G^{10} each carrying an incline G^{11}. The slides can be moved nearer to or farther away from one another by screws G^{12} on concentric axes see Fig. 2^{x}. One screw acts on one slide and the other screw on the other. One axis has upon it two ratchet wheels G^{13} the teeth of which are in opposite directions. The other axis has also upon it two similar ratchet wheels G^{14}. The pawls for driving these wheels are carried by four levers F which turn on a fulcrum at F^{3}; the other ends of these levers have pins F′ projecting from them which are acted on or left at rest by the Jacquard cards whenever the jacquard is moved up to the needles

In Fig. 5, the Jacquard barrels are shown in their raised positions; one lever F, (the front one,) is shown to have been acted upon by the jacquard, the other, (the back one) remaining out of action, there being a hole in the Jacquard card opposite to its pin F′. The pawls are pressed toward the ratchet wheels by springs F^{6}. The levers are drawn upward by coiled springs F^{4} attached to a portion of the frame-work of the machine. Each pawl is formed with a tail piece F^{5}. When the Jacquard barrel descends the levers F previously acted upon by it are drawn upward by their coiled springs F^{4}, and the tail pieces F^{5} of their

pawls strike against a fixed bar F^4, and so disengage the pawls from the wheels. The bar F^4 is an extension from an arm F^7 that stands up from the portion of the framing that carries the bearings for the axes of the ratchet wheels. The splicing thread is carried on the front of the thread carrier, and passing down through G, with the foundation thread, is carried by it to the needles. It passes first through a hole in a spring G', see Figs. 4, 4^a, 4^b, 4^c, and 4^d and when free passes in continually with the main thread, but by turning the T shaped piece G^2 so as to press upon the spring, the thread is broken, and when desired to run it in again, this piece G^2, is pushed aside so as to free it. This enables the splicing thread to be either run in continually or to be broken off at the end of the course on one bed.

To actuate the T-shaped piece G^2, I have a series of stops on the circumference of two wheels, carried on two arms G^{12}, which stand up from the slides G^{10} which carry the inclines G^{11} for regulating the throw of the thread carrier. When G^2 is vertical, the splicing thread is broken. When G^2 is inclined in either direction, the thread is free and passes into work with the other thread. If the splicing thread is not to be inserted either when a course is being made from right to left or vice versa, then both stop wheels G^6 are in the position shown at Fig. 4^b and G^2 remains in a vertical position. If a splicing thread is to be inserted in courses made from left to right, then the left-hand stop wheel G^6 is turned into the position shown in Fig. 4^a, so that the left hand end of G^7 comes against one of the longer projections of G^6. If, on the other hand, a splicing thread is to be inserted in courses made from right to left, the right-hand end of G^7 comes against one of the longer projections of the right hand wheel G^6. The wheels G^6 are turned into the positions required for making these changes by a ratchet wheel G^5 on the axis which carries them, it being acted on by a pawl G^4, which at its lower end is jointed to an arm K^7 which can turn freely around the axis of the arm K, while its upper end is by a spring Ga, (shown in Fig. 4) held against the ratchet wheel G^5. When the arm is acted upon by a pin M^2, on the chain M^3, the pawl is raised and gives a partial turn to the ratchet wheel. When the pin passes from below the arm, the arm and pawl descend by their own weight. A feather projecting inward from the boss of each wheel G^6 enters a groove f^7 (see Fig. 2) formed along the shaft that carries them, so that these wheels may be moved toward or away from one another and yet always be turned by the shaft.

For shogging the movable needle bed, I fix to the right hand end of it a short rack K^3 the teeth of which fit into zigzag cam grooves K^2 formed around a cylinder to which a step by step revolving motion is given at the proper times. When the cam revolves, it moves the bed first to the left, then has a straight place and stands still. Afterward it moves it back again, and stands still again. The cam is shown at K^2, and the motion is given by the lever K, acting upon a ratchet K^4, on the axis K' of the cam K^2, and actuated by a stud M^2 on the chain M^3.

In order fully to show the working of the machine, I will proceed to describe the mode of making a fashioned stocking by widening, and commencing at the toe. I first make two ribbed courses, of any desired width, by lifting the required number of needles up at both sides through the jacquards L and L'. They are then raised sufficiently high to catch the thread from the thread carrier G, and brought down again by the stitch cam Db and the corresponding one on the opposite bed. After these two ribbed courses, I make one plain course on each side, which is done by the jacquard acting alternately on each side so making a tube. I then shog the back needle bed the distance of two needles to one side say to the right by means of K K', K^3, K^2, so as to leave two needles more at one end of each bed than at the corresponding end of the other, so that if making ribbed work, there would be a needle wanting, say, at the right hand end of the front bed, and at the left hand end of the back bed. I now work a course from left to right on the back bed, and on the front bed bring up only one needle a^x to fill up the vacant space. This needle having no loop on it, lies between the two outer needles of the opposite bed, in such a manner, that the yarn between them, generally known as the sinker loop, is laid over the empty needle. See Diagrams C, D, and E. I next make a course on the front bed when the thread being caught by the front row of needles, is worked into the sinker loop lying round the new needle, thus filling up what would have otherwise been a hole, and widening the fabric by one needle. During the making of this course, a single needle a^{xx} has been raised at the left hand end of the back bed so as to bring another needle into action in the way already described. A plain course is now made on both beds, and the back bed then shogged two needles to the left so as to repeat the operation of widening. This is continued as long as necessary to attain the width desired for the toe, after which a number of plain courses are made until the gusset is reached. The necessary number of widenings are then made in a similar manner to that above described and afterward the heel is made by working backward and forward on the front bed only and on a varying number of needles, so as to produce what is known as the Griswold heel. Then follow a number of plain courses on each side to make a plain tube until the calf when the work is again widened and afterward a plain tube of full width, completes the stocking. In this way I obtain a properly shaped foot narrower than the leg—and the leg also properly fashioned. By the splicing mechanism herein-

before described I can also put in a full spliced toe and heel and spliced sole, splicing half round for some distance above the heel, and splicing half round at the knee.

In making the heel, when a needle has been withdrawn, I raise it again the next course, sufficiently high to catch the thread for the new loop, but not sufficiently for it to be caught by the cam *Da*, so that when it is brought down again, it has two loops on, which remain on until the needle is again required for widening up the heel. To accomplish this I cut the under side of the cam *Da* shorter so that the needles require lifting one-eighth inch higher to be caught by it, and the Jacquard plates have a thin piece of iron plate L^{xxx} riveted on them as shown in Fig. 3 so as to thicken them to the extent necessary to give the extra lift. Where I require to lift up a needle the lesser distance, this extra piece of iron is cut away, so as to lift it a less distance. This tucks one or more needles.

In some cases in making a stocking in place of commencing at the toe as above described and working the stocking upward I place on to the needles a rib top and work the stocking downward.

What I claim is—

1. The combination of two parallel needle beds, a thread layer, means for operating it, cams for raising and for lowering the needles reciprocated to and fro along each needle bed, the lowering cams being so formed as to lower the needles out of reach of the raising cams, a continuous chain of Jacquard cards for each needle bed, mechanism for bringing one of such cards against the ends of the needles just before a course of work is made on that bed so as to raise such of the needles as are to be brought into work and bring them within reach of the raising cam-control mechanism which controls whether the Jacquard mechanism shall come into action or remain out of action, and means for holding the advancing down-throw cam above the needles raised into action by the jacquard.

2. The combination of two parallel needle beds, a thread layer, means for operating it, cams for raising and for lowering the needles reciprocated to and fro along each needle bed, the lowering cams being so formed as to lower the needles out of reach of the raising cams, a Jacquard barrel with a continuous chain of cards passing over it below each needle bed,—mechanism for raising each Jacquard barrel against the ends of the needles of the bed above it just before a course of work is made on that bed,—mechanism for giving a partial turn to each Jacquard barrel as it is moved back away from the needles, control mechanism for bringing into action or not bringing into action the Jacquard barrels at each course and means for holding the advancing down-throw cam above the needles raised into action by the jacquard.

3. The combination of the two parallel needle beds one capable of being moved endwise to and fro, the thread layer, means for operating it, the cams for raising and lowering the needles; the lowering cams being so formed as to lower the needles below the reach of the raising cams, the Jacquard mechanism for raising needles in either bed, mechanism for shifting the bed endwise, the pattern chain for controlling its movements at the times required, so as when the work is to be widened to enable a needle which is to be brought into work at the end of one bed to be made to rise between the last two end needles in the other bed to have the thread with which a course of work is made on the needles of that bed laid across it, and means for holding the advancing down-throw cam above the needles raised into action by the jacquard.

4. The combination of the two parallel needle beds, one capable of being moved endwise to and fro, the thread layer, means for operating it, the cams for raising and lowering the needles, the lowering cams being so formed as to lower the needles below the reach of the raising cams, the Jacquard mechanism for raising the needles in either bed, and mechanism for retaining a splicing thread or allowing it to pass with the main thread into the work so as to splice or thicken the work produced either on the one bed or the other or on some of the needles on one bed and some on the other, and means for holding the advancing down-throw cam above the needles raised into action by the jacquard.

5. The combination of two parallel needle beds, a thread layer, means for operating the thread layer, cams for raising and lowering the needles means for operating them in such manner that work is first produced on the needles of one needle bed and then on the other so as to produce tubular work, a spring upon the thread layer having an eye for a thickening thread led through the same thread layer, the rocking lever engaging the spring for nipping and holding this thickening thread or allowing it to run free, and automatic mechanism for controlling the position of the lever to make it hold or release the thread at the times required, substantially as described.

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581

(No Model.) 2 Sheets—Sheet 1.

G. SOWTER.

FASHIONING APPARATUS FOR STRAIGHT KNITTING MACHINES.

No. 478,527. Patented July 5, 1892.

Fig. 1.

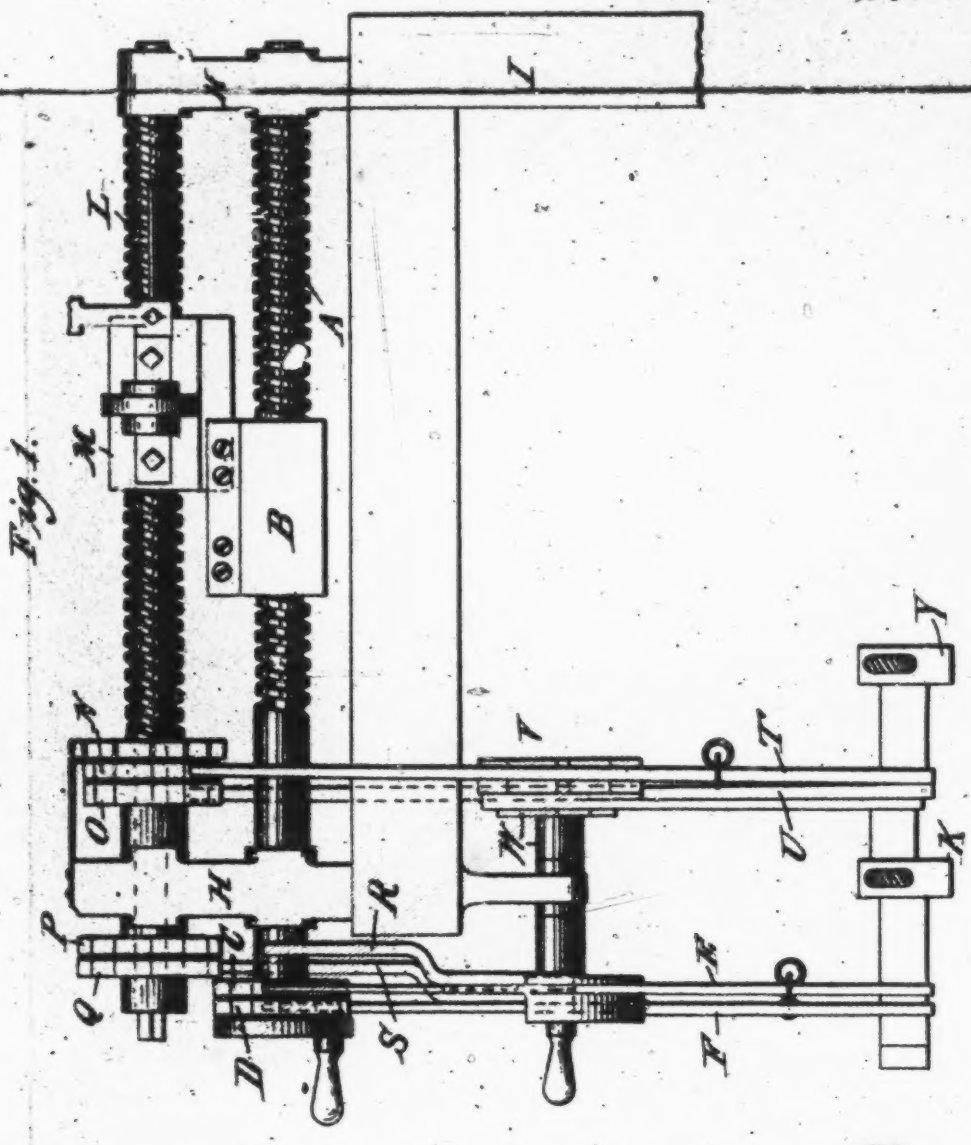
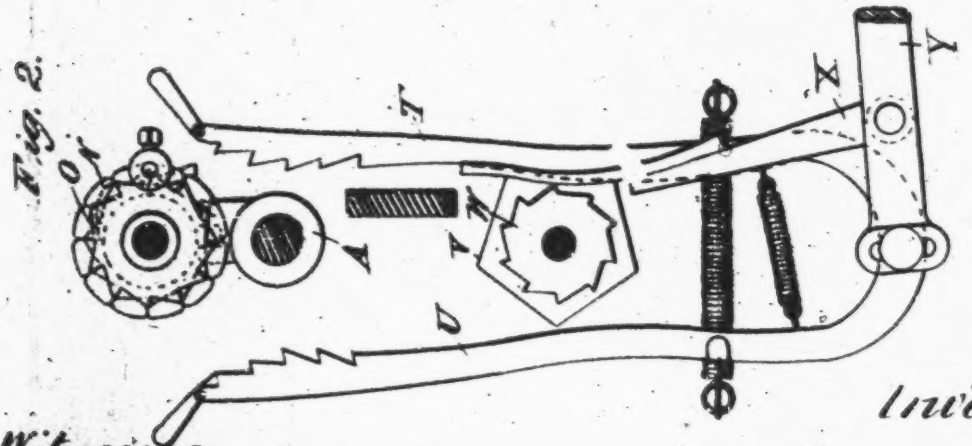


Fig. 2.



Witnesses:
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Thomas Bernard Redgate

Inventor:
George Sowter

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(No Model.) 2 Sheets—Sheet 2.

G. SOWTER.

FASHIONING APPARATUS FOR STRAIGHT KNITTING MACHINES.

No. 478,527. Patented July 5, 1892.

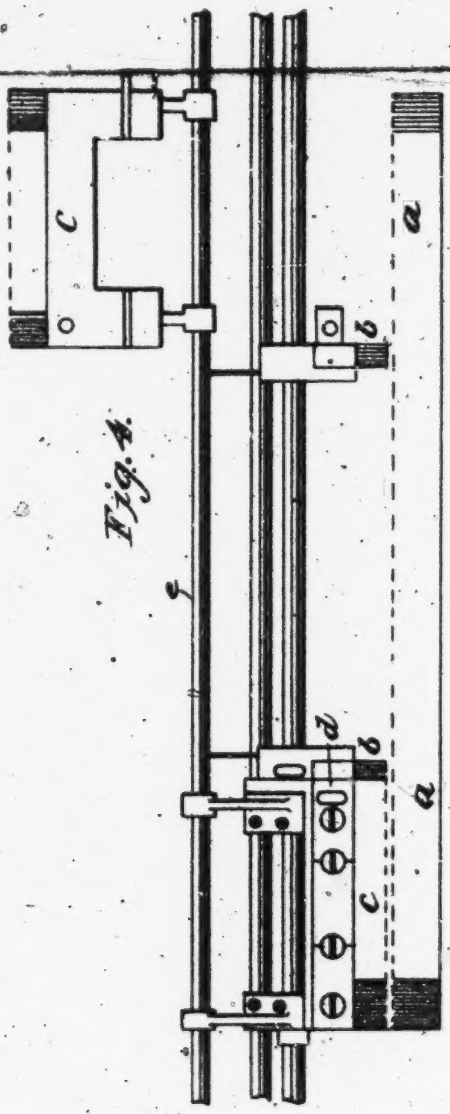

Fig. 4.

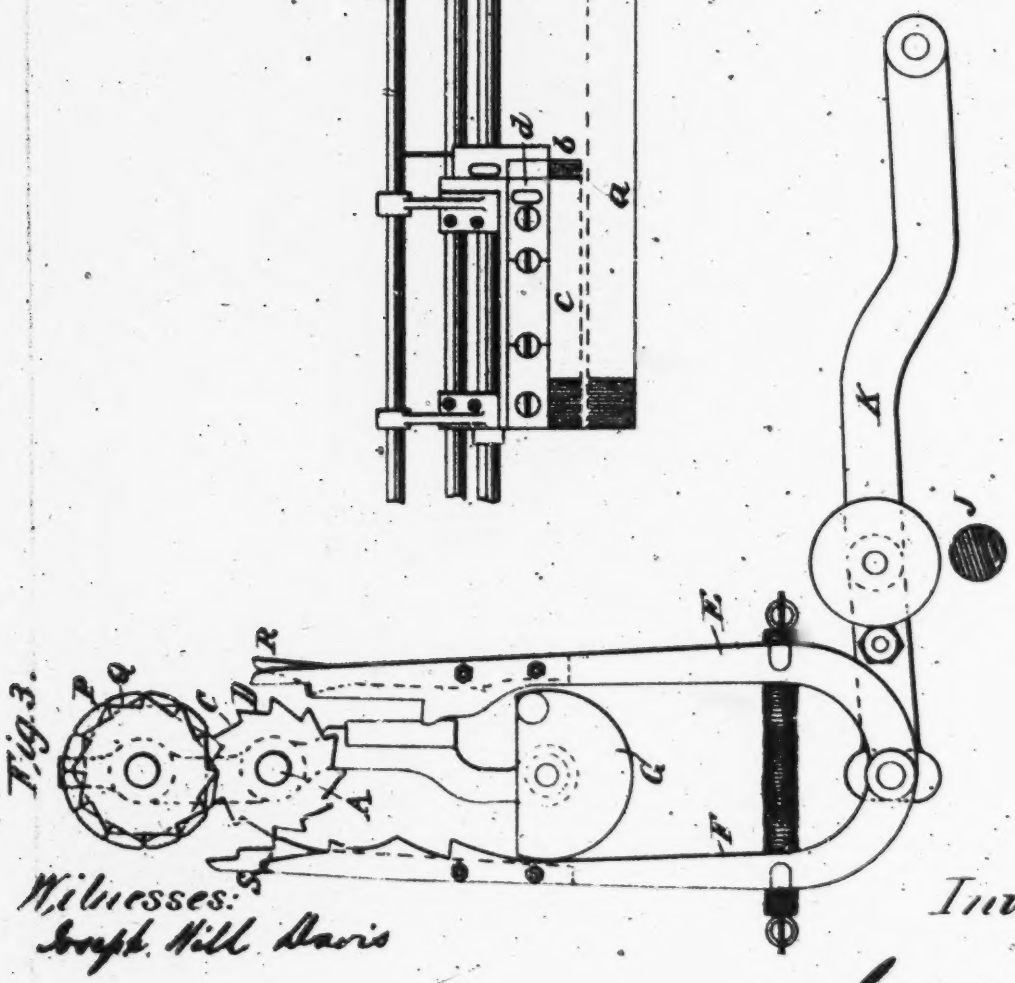

Fig. 3.

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UNITED STATES PATENT OFFICE.

GEORGE SOWTER, OF NOTTINGHAM, ENGLAND.

FASHIONING APPARATUS FOR STRAIGHT-KNITTING MACHINES.

SPECIFICATION forming part of Letters Patent No. 478,827, dated July 5, 1892.

Application filed October 22, 1889. Serial No. 327,552. (No model.) Patented in England December 18, 1888, No. 18,461.

To all whom it may concern:

Be it known that I, GEORGE SOWTER, hosiery-manufacturer, a subject of the Queen of Great Britain, residing at 88 The Chase, St. Ann's Well Road, Nottingham, England, have invented certain Improvements in Fashioning Apparatus for Straight-Knitting Machines, (for which I have obtained a patent in Great Britain, No. 18,461, bearing date December 18, 1888,) of which the following is a specification.

My improvement relates to knitting-machines, known as "Cotton's system," employed in producing articles known as "hose," "socks," "pants," "vests," or similar articles in which widenings and narrowings are required at any distance from the selvage. The usual mode of working the widening and narrowing instruments, which are carried by rods or bars, is by attaching such rods or bars to the screw-box carrying the selvage-stops and moving them at the same time. By this mode only one uniform set of widenings or narrowings can be made—that is, if the instruments are set to work four heads or eight needles from the selvage they traverse with the stops and remain at one uniform distance from the selvage of the fabric. I propose to lengthen the brackets carrying the screw upon which the stops for the thread-layer are traversed to the right or left and carry with these brackets a separate screw, upon which a box with arm is attached to traverse the points or instruments to the right or left independently of the selvage-stops by the following means: The outer end of axle of the top screw is provided with two ratchet-wheels and clawkers. The clawkers are fastened with bolts to the ordinary clawkers, which drive the screw, upon which stops for the thread-layers are traversed, thus giving a simultaneous movement to widen or narrow from the selvage in the usual manner. A second pair of ratchet-wheels is placed on the axle of the top screw inside the end bracket, driven by clawkers hinged to a lever rocking on an axle carried by the framing of the machine, the lever having a rising-and-falling movement given it by a cam to traverse the instruments to the right or left before the screw and stops for the thread-layers are put in motion. The axle for the cam for narrowing and widening, which is moved by hand between the outside clawkers, is made longer to carry a pentagonal cam and ratchet-wheel inside to throw the clawkers in gear in one side and out of gear on the other alternately by a small ratchet hinged to the outside lever, which has a rising-and-falling movement and is automatic in its action. I also propose to use a wide set of points or instruments for transferring the loops to the right or left, as required. These leads and instruments are carried on rods or bars attached to the narrowing-machine and fitted up to the ordinary instrument or coverers used on the selvage when in action. By this arrangement the ordinary instrument used on the selvage can be traversed by the top screw to the required distance inside the fabric from the selvage and the wide set of instruments brought down to the instruments used on the selvage to transfer the loops when widening or narrowing is required any distance from the selvage of the fabric, so as to form pockets or gores without seams, being required in ladies' vests, or forming the heels of stockings without seams, and such like articles.

Figure 1 is a front view with cam-shaft removed; Fig. 2, a sectional end elevation; Fig. 3, an end elevation; Fig. 4, a front elevation of one set of needles, showing one set of points or instruments attached to the selvage points or instruments and one set separated from the selvage points or instruments.

A, Fig. 1, is the screw for working the selvage-points, as in the ordinary machine, with its box B, ratchet-wheels C and D, clawkers E and F, while I is part of machine-standard.

For working my improvement I lengthen the bracket H H to carry the ordinary screw A with its box B, also to carry the special screw L with its box M. On the end of screw L are two pairs of ratchet-wheels N and O and P and Q, the latter being worked from clawkers E and F by attaching to them additional clawkers R and S, which have a rising-and-falling movement, as in the ordinary machine. The other pair of ratchet-wheels N and O, I work from clawkers T and U by means of a cam and lever Y, similar to those used for clawkers E and F, to traverse points or instruments five needles to the right or left alternately before the instruments reach the needles, to transfer the loops one needle to the right or left to extend or contract the fabric.

I also lengthen the axle of the cam G, Fig. 3, to carry a cam V, Fig. 2, with an odd number of faces and a ratchet-wheel W, having twice as many teeth as the cam V has faces. In the drawings they are shown as ten and five, respectively, the wheel W being attached to cam V. To lever Y, Fig. 2, which operates the clawkers T and U, I pivot a pawl X, which in rising works the ratchet-wheel W and turns the cam V half the length round of the odd face, thus insuring the automatic revolution of the cam V, and throws out of gear the clawkers T and U alternately, causing the screw L to traverse box M to the right or left five needles at each upward movement.

In Fig. 4, *a a* are the needles on which the fabric is made; *b b*, the points or instruments for narrowing or widening, which are connected to the box M on screw L in the usual manner. The bars or rods carrying the points *b* are each attached to a box M in the usual manner, and one of said rods is shown in Fig. 1 of the drawings as broken off. At each end of the machine, as shown in Fig. 4, in addition to these narrow points *b*, I use a wide set of points *c c*, eight inches long, on each side of the division of the machine. Fig. 4 shows one division of the machine. These wide points I secure to the ordinary points *b b* by screws *d*, so that they can both be moved as one piece from the top screw, and are carried by a shaft *e*, attached to the machine. The points *c* on the right-hand side, Fig. 4, are shown separated from the selvage-points, being partially revolved about the shaft *e* when out of active; but I do not confine myself to any particular method of separating the points or instruments.

Having described the drawings of my apparatus which is applied to each end of the knitting-machine, I will proceed to explain the working of the same, so that it may be fully understood. In making a lady's vest, fashioned gore, or besom without a seam in the gore, I make the bottom portion of the body in the usual manner to the commencement. To widen and form the gore, the instruments *b* are traversed in five or six inches, as required, from the selvage. The wide set of instruments *c* is then secured by screws *d* to the instruments *b b*. Clawkers E and R, Fig. 1, acting on ratchet-wheels P and C, attached to screws A and L, traverse the boxes B and M and points *c b* simultaneously, extending the selvage and stops B one needle outward. At the same time the pawl X in rising works the ratchet-wheel W on cam V, throws in gear clawker U, and clawker T out of gear. I then draw two or more courses. Clawker U rises, acting on ratchet-wheel O, and traverses box M and points *c b* five needles inward from the last widening. Clawkers E and R come into operation again, extending the selvage one needle. At the same time pawl X, acting on ratchet-wheel W on cam V, throws in gear clawker T and out of gear clawker U. I then draw two or more courses. Clawker T, coming into action on ratchet-wheel N, traverses box M and points *c b* four needles outward, thus making two rows of fashioning and leaving the points one needle inward from the selvage. When eighteen or more widenings, as required, are made, I turn the cam G by hand and bring into action clawkers T and S to narrow the fabric in the same manner, the number of courses required forming the gore without a seam, leaving the same width on the machine. I then disconnect the points or instruments *c*, traverse the points *b* on to the selvage, and proceed to make the remaining portion of the body in the usual manner. To make pants with what are known as "split hips" and "twisted ankles" without a seam in the hips or ankles, I traverse in the points six or seven inches, secure the wide instrument *c* to points *b* by screws *d*, and proceed to widen out the two selvages, same as in gore, six or seven leads, as required. I then disconnect instruments *c*, traverse points *b* on to the selvage, widen out the pants in the usual manner to the gusset and narrow them down the thigh, make five or six inches plain, traverse in the points *b* on one side only four or more inches, secure instruments *c* to point *b*, and proceed to narrow the ankle, same as gore, in vest for ten or more leads, as required.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The combination, in a straight-bar knitting-machine, of the lengthened brackets H, screws A and L, respectively carrying selvage-stops B and fastening-box M, and pawls and ratchet-wheels for operating said screws, substantially as described.

2. The combination of the screws and their ratchet-wheels with the clawkers E and F, having attached thereto the clawkers R and S to move the screws at the same time, substantially as described.

3. The combination of the clawkers U and T with the cam V, ratchet-wheel W, and pawl X to control said clawkers, substantially as described.

4. The combination of shaft E and wide sets of points *c*, hinged thereto, with selvage-points *b* and screws *d* to connect said wide points and selvage-points, substantially as described.

5. The combination of screw A and selvage-stop B with screw L, box M, ratchet-wheels N and O, and clawkers U and T to revolve said screw L independently of said screw A, substantially as described.

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586

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ATTACHMENT FOR STRAIGHT KNITTING MACHINES.

APPLICATION FILED JAN. 6, 1914.

1,198,482.

Patented Sept. 19, 1916.

5 SHEETS—SHEET 1.

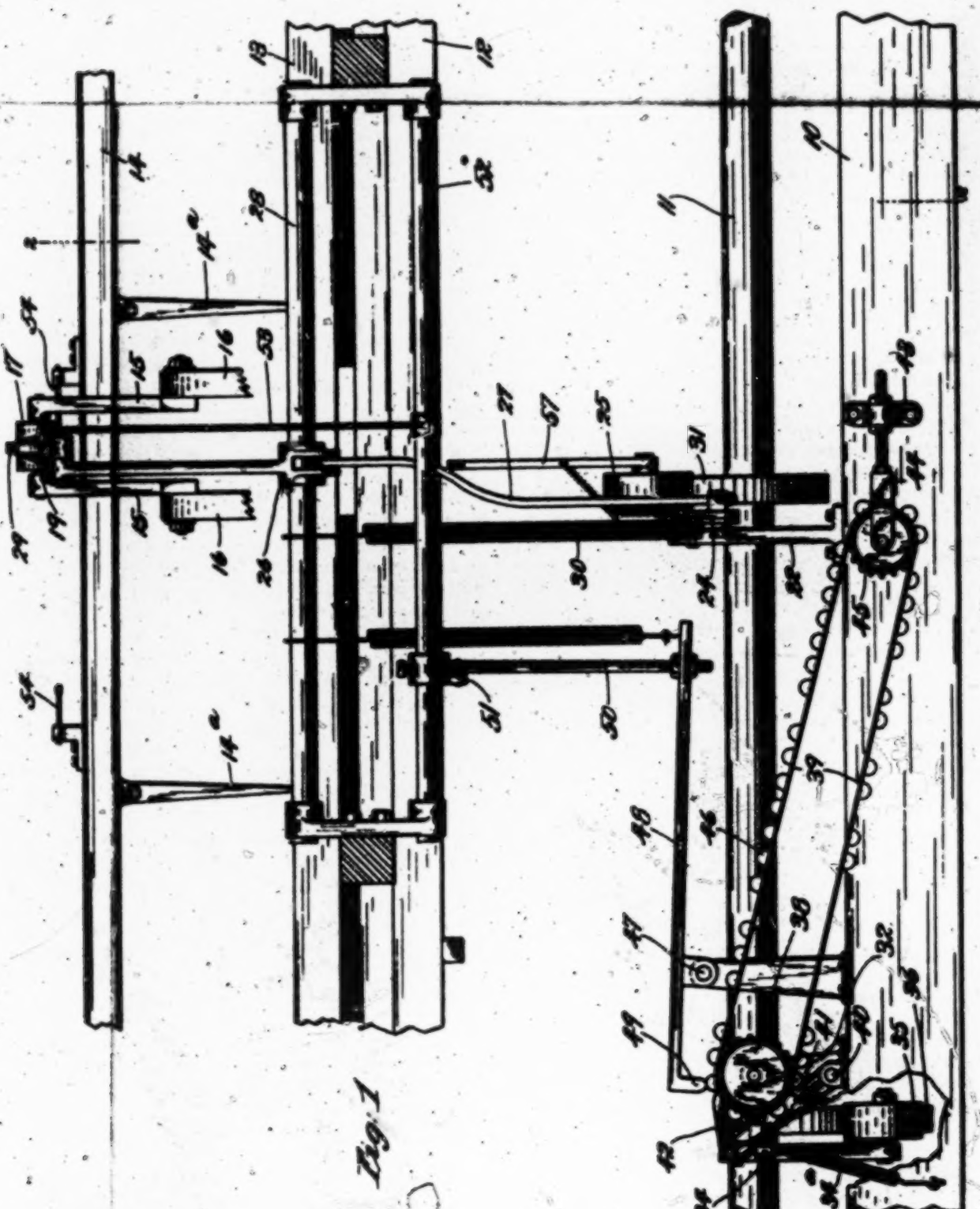

Fig. 1

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587

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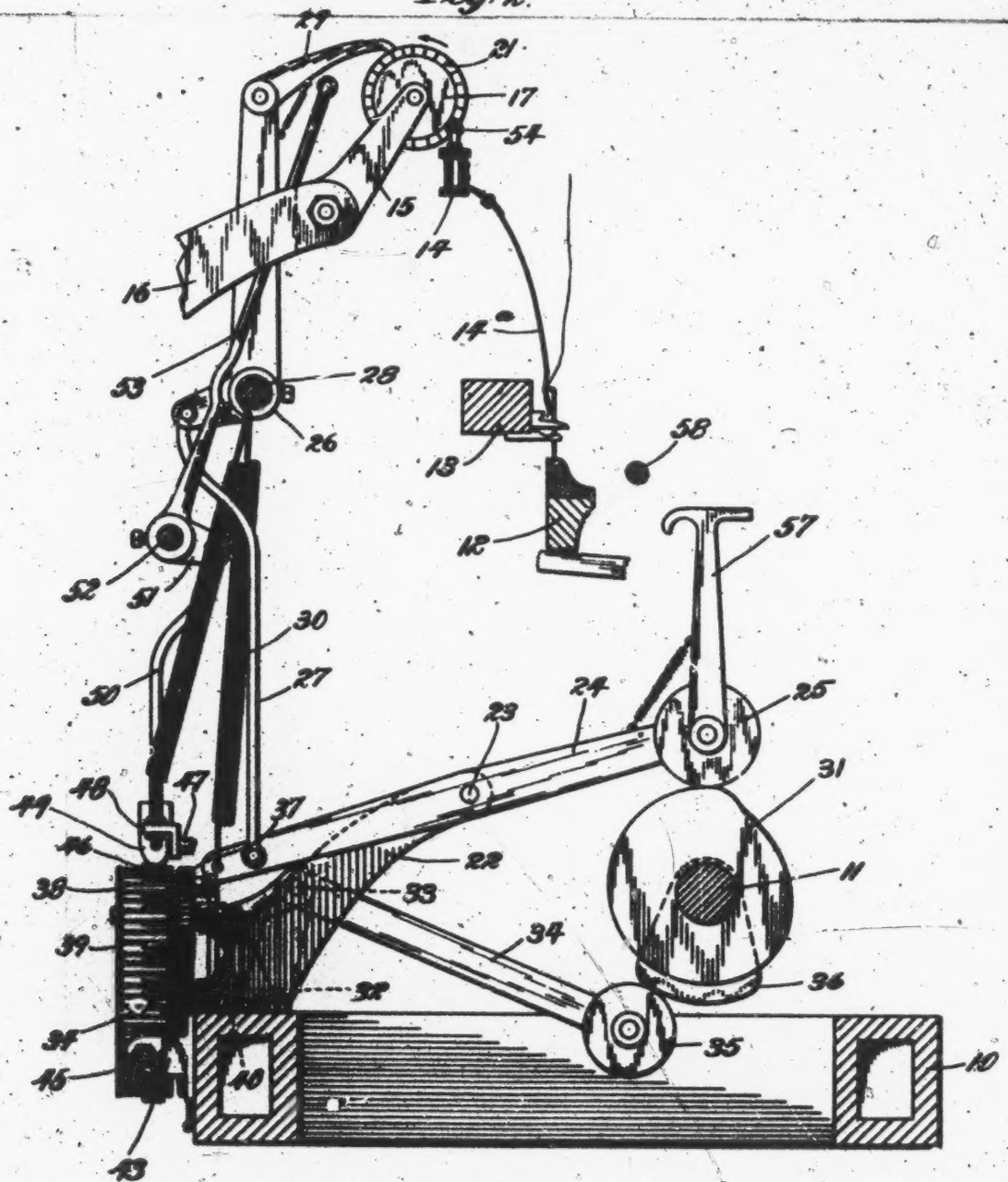
APPLICATION FILED JAN. 6, 1914.

1,198,482. Patented Sept. 19, 1916.

5 SHEETS—SHEET 2.

Fig. 2.



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R. E. SCHLETTER.

ATTACHMENT FOR STRAIGHT KNITTING MACHINES.

APPLICATION FILED JAN. 6, 1914.

1,198,482.

Patented Sept. 19, 1916.

5 SHEETS—SHEET 3.

Fig. 3.

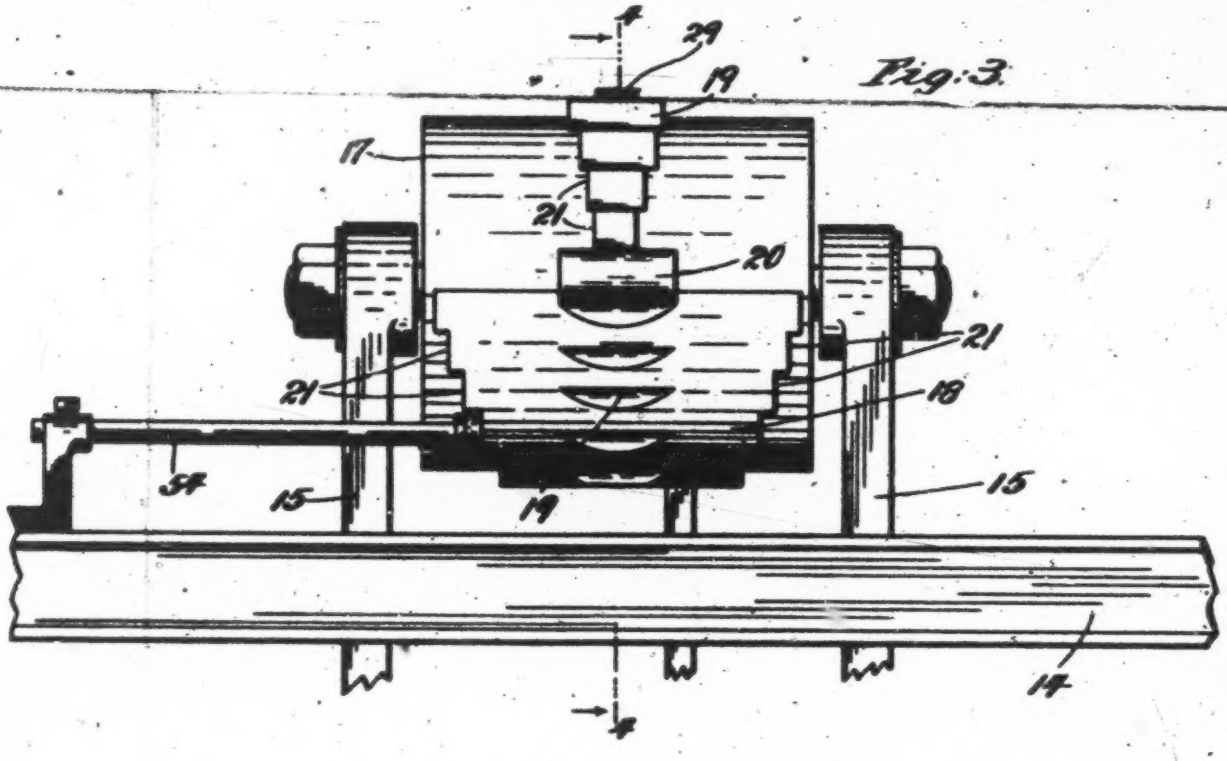
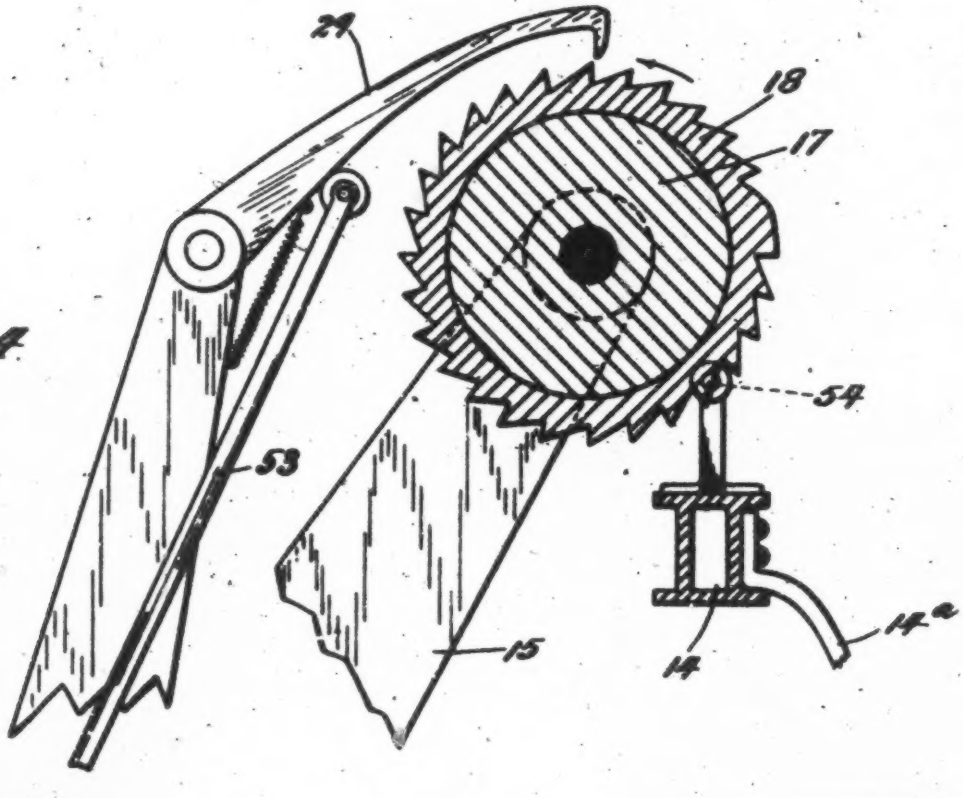


Fig. 4.



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APPLICATION FILED JAN. 6, 1914.

1,198,482.

Patented Sept. 19, 1916.

5 SHEETS—SHEET 4.

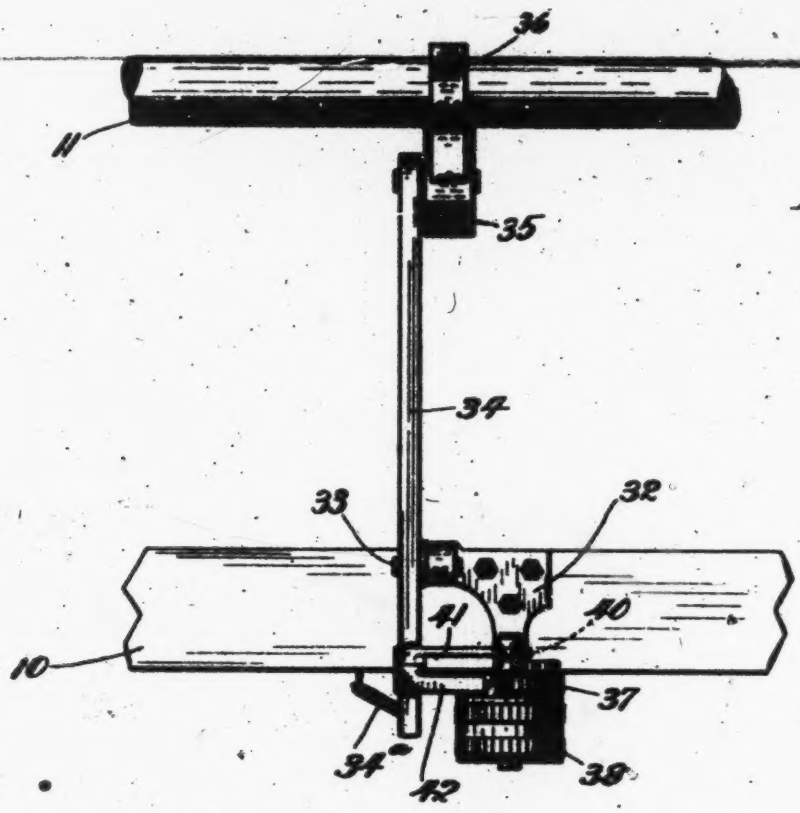


Fig. 5.

Fig. 8.

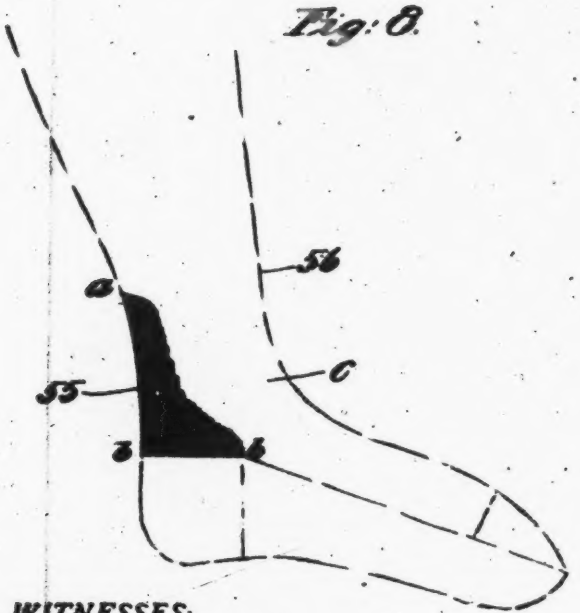
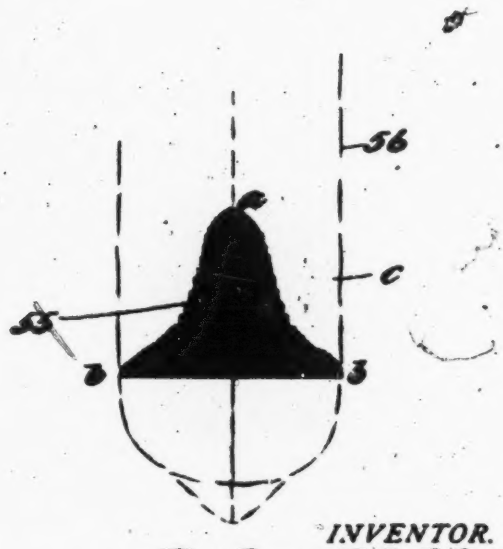


Fig. 9.



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ATTACHMENT FOR STRAIGHT KNITTING MACHINES.

APPLICATION FILED JAN. 6, 1914.

1,198,482.

Patented Sept. 19, 1916.

5 SHEETS—SHEET 5.

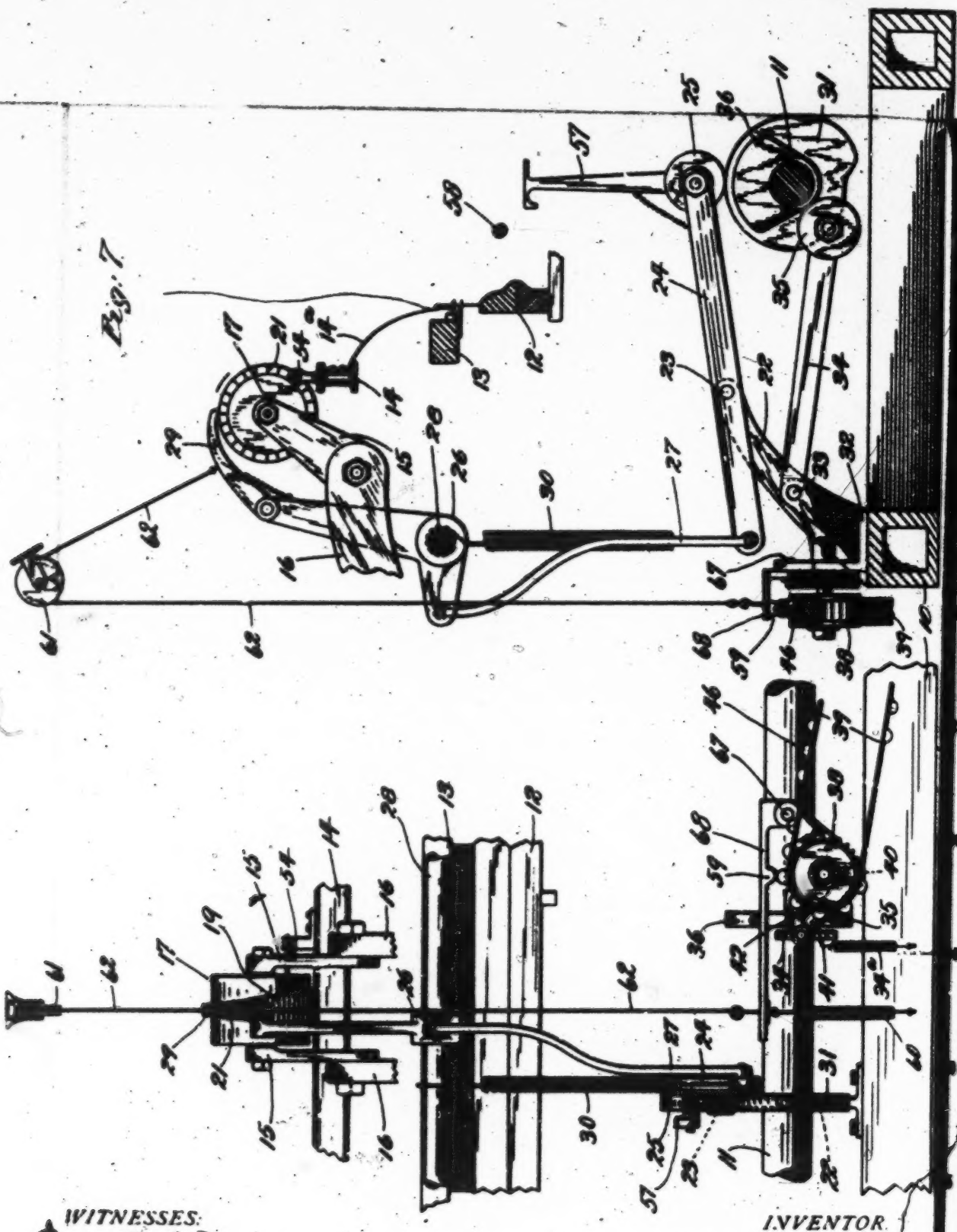

Fig. 6

Fig. 7

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UNITED STATES PATENT OFFICE.

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ATTACHMENT FOR STRAIGHT-KNITTING MACHINES.

1,198,482. Specification of Letters Patent. Patented Sept. 19, 1916.

Application filed January 6, 1914. Serial No. 810,660.

To all whom it may concern:

Be it known that I, RICHARD ERNST SCHLETTER, a subject of the Emperor of Germany, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a certain new and useful Attachment for Straight-Knitting Machines, of which the following is a specification.

This invention broadly stated relates to straight-bar knitting machines and has more particular relation to an attachment therefor for plotting or fashioning a reinforce portion for the heels of stockings.

The principal object of the present invention may be said to reside in the providing of a simple, efficient and comparatively inexpensive mechanism adapted for attachment to an ordinary straight-bar knitting machine without change of construction or operation of the machine parts whereby a neat and efficient reinforce may be plotted or fashioned for the heel portion of stockings.

Other and further objects of the present invention reside in the providing of general details of construction and arrangement and operation of parts as will hereinafter more fully appear.

The nature, characteristic features and scope of the invention will be more fully understood from the following description taken in connection with the accompanying drawings forming part hereof and in which:

Figure 1, is a view in rear elevation illustrating the attachment of the invention in application to so much of a straight-bar knitting machine as is necessary to an understanding of the invention, Fig. 2, is a view in section taken upon the line 2—2 of Fig. 1, Fig. 3, is a fragmentary view in front elevation of the upper portion of Fig. 2, Fig. 4, is a view in section taken upon the line 4—4 of Fig. 3, looking in the direction of the arrows, Fig. 5, is a fragmentary view in plan of the left-hand side of Fig. 1, Fig. 6, is a fragmentary view, in rear elevation, of a slightly modified form of the invention, Fig. 7, is an end view thereof, partly sectioned, and Figs. 8 and 9, are views in side and end elevation respectively of a stocking equipped with the reinforce as plotted by the attachment embodying the invention.

Referring to the drawings, there is illustrated a physical embodiment of the invention constructed in accordance with the mode best known to me at this time for practising the invention. Obviously, various details of construction and arrangement of parts may be altered without departing from the spirit of the invention.

In the specific embodiment of the invention disclosed in Figs. 1 to 5, inclusive of the drawings, 10, designates the frame of a straight-bar knitting machine of any suitable design. 11, designates the main driving shaft thereof, 12, the vertically reciprocating needle bar, 13, the sinker head and its sinkers, including complemental bits and 14, the horizontally disposed reciprocating carrier bar and its thread carriers 14^a. These parts are of ordinary and well known construction and form no part of the present invention. The attachment of the invention is designed for application to the center division of a knitting machine and is adapted to regulate, in each division, the formation of stocking heel reinforcement.

Rotatably supported between brackets 15, carried by a suitable part 16, of the frame of the knitting machine and in the path of travel of the carrier bar 14, is a plotting, pattern or fashioning cylinder 17, see Figs. 3 and 4. This cylinder is located immediately above the carrier bar 14, which bar is provided with stops, hereinafter referred to, which in abutting against the cylinder limit the bar movement. The cylinder 17, is provided with a concentric covering 18, circumferentially provided with teeth 19, a blank tooth 20, however being present, see Figs. 3 and 4, for a purpose to be presently described. The covering 18, is so cut away that upon each side thereof its edges are notched as at 21, in a step-like manner for a purpose to be presently described. In other words commencing at a point adjacent the blank tooth 20, the surface of the covering gradually increases in width throughout the circumference of the cylinder.

A description will now be given of the mechanism for operating the cylinder 17. Carried by the frame work 10, of the knitting machine is a bracket or support 22, fulcrumed to which as at 23, is a lever 24, one end of which lever carries a roller 25, and the opposite end of which lever has connection with the short arm of a bell-crank lever 26, as by means of a rod 27, the bell-crank lever 26, having fixed relation with a rock shaft 28. The long arm of the bell-crank lever 26, has pivoted thereto a spring impelled

pawl 29, for pawling the cylinder 17. A cam 31, fixed to the main driving shaft 11, is adapted to coöperatively engage the roller 25, of the lever 24, to effect the pawling of the cylinder 17. A coiled spring 30, is interposed between the rock-shaft 28, and the free end of the lever 24, for insuring the return of the rock-shaft and its complemental parts to normal position. In order to permit of the proper pawling of the cylinder 17, other mechanism is present, a description of which will now be given. Secured to the frame 10, of the knitting machine is a bracket 32, see Fig. 5, fulcrumed to which as at 33, is a lever 34, one end of which lever is connected to the frame 10, by means of a coiled spring 34a, and the other end of which lever is provided with a roller 35. The roller 35, is adapted to be coöperatively engaged by a cam 36, fixed to the main driving shaft 11. Journaled to the bracket 32, at right angles to the fulcrum point 33, of the lever 34, is a ratchet wheel 37, see Fig. 5, and on the same journal carrying the ratchet wheel is a sprocket wheel 38. Having pivotal connection as at 40, with the bracket 32, is a lever 41, pivoted to which is a pawl 42, for pawling the ratchet wheel 37. The lever 34, and the lever 41, are so arranged at an angle with respect to one another that as the cam 36, operates the lever 34 vertically or up and down, the lever 41, together with its pawl 42, is reciprocated back and forth for imparting motion to the sprocket wheel 38. Having adjustable connection with a bracket 43, fixed to the frame 10, is a forked member 44, see Fig. 1. Pivotally carried by the forked member 44, is a second sprocket wheel 45. A sprocket chain 39, is accommodated by the sprocket wheels 38 and 45. Fixed to the sprocket chain 39, are buttons or projections 46, arranged and designed to coöperate with the pawl releasing mechanism about to be described. Fulcrumed as at 47, to a suitable part of the knitting machine is a lever 48, one end of which is provided with a depending lug or projection 49, and the opposite end of which connects, as by means of a rod 50, with a crank 51, fixed to a second rock-shaft 52. This rock-shaft 52, has fixed thereto, an upwardly extending rod 53, the upper end of which is adapted to co-act with the pawl 29, to raise the same at predetermined intervals, and to permit the pawl to be returned to operative position. It may be here stated that the spacing of the projections or buttons 46, upon the sprocket chain 39, determines the operation of the rod 53, and the lifting of its complemental pawl 20. Thus as a button 46, elevates the lug or projection 49, of the fulcrumed lever 48, said lever through the instrumentality of the rock-shaft 52, causes the free end of the rod 53, to recede from the pawl 29, to permit the same to pawl in the direction of the arrow in Fig. 2, the cylinder 17. Obviously, as a button 46, leaves the lug or projection 49, of the lever 48, the part 49, drops between adjacent buttons thereby causing the free end of the rod 53, to abut against the underside of the pawl 29, see Fig. 4, and raise the same from the teeth 19, of the cylinder 17, until another button 46, operates the rod 53 at the proper time whereby said pawl through the operation of the lever 24, connection 27, rock-shaft 28, and bell-crank lever 26, engages another tooth of the cylinder 17, and so on. It will be understood in this connection that the cams 31, and 36, are arranged and timed to coöperate with the described parts so as to properly accomplish desired results. The covering 18, of the cylinder 17, is shaped and proportioned marginally considered as described to coöperate with rods 54, adjustably fixed to the carrier bar 14. As clearly shown in Fig. 1, these rods or stops 54, are arranged upon the carrier bar 14, so that in its reciprocation back and forth first one rod or stop and then the other abuts against the notched side walls of the covering 18, of the cylinder 17. Thus as the cylinder 17, is pawled, the reciprocating movement of the carrier bar 14, is gradually lengthened as the stops 54, in a step by step manner abut against the gradually decreasing contour of covering side walls in one revolution of the cylinder 17. This lengthening of the stroke of the carrier bar 14, determines the shape or configuration of the reinforced portion 55, of a stocking 56, see Figs. 8 and 9, because the thread carriers co-act with a gradually increasing number of needles.

In manufacture, the stocking 56, is of the full fashioned type, the web of which has selvage edges. Before the point designated *a*, in the drawings is reached, the stocking web is knit in a well understood manner. When the point designated *a*, is reached, the carrier bar which has the thread carriers thereon, for supplying reinforcing thread to the needles, which knit the selvage edged web is thrown into action by well understood mechanism. This is so that the reinforce thread may be knit in successive courses, to cause the inner ends of the courses of the heel reinforcement to define a symmetrically curved, but zig-zag-like line, which taken as a whole is inclined to the wales and courses of the web. From the point *a*, to the point *b*—*b*, varying numbers of needles are supplied with thread to form a heel-reinforce inwardly from the selvage edges. During the knitting above described the pawl 29, has been idly engaging the blank tooth 20. The operator with the heel reinforce carriers in operation now manually moves the cylinder 17, so that the pawl engages the tooth adjacent the widest portion of the covering 18. As the cylinder 17, is

pawled the narrower portions of the covering 18, are advanced until finally in one complete revolution of the cylinder and by a step by step movement, the widest part *b—b* of the reinforce has been knit, as of course has been the part *c*, of the stocking. The heel reinforce thread carrier bar is then stopped and pawl 29, now again moves over the blank tooth 20, so that the cylinder 17, remains idle. The foot portion of the stocking is now formed in the well understood method of stocking manufacture and the stocking bottom and stocking back sewn up. If desired, the lever 24, may be entirely removed from contact with its complemental cam 31, by causing the hooked portion of its complemental hand-piece 57, to engage a suitable support 58. The pawl 29, then remains idle.

In the modified form of the invention shown in Figs. 6, and 7, of the drawings, a simplified construction is disclosed. The fashioning cylinder, pawling mechanism and the sprocket chain and its operating mechanism are of the same construction as hereinbefore described although the position of the latter is changed. The mechanism for lifting the pawl 29, free of the teeth of the fashioning cylinder 17, however, is much simplified. As shown in said figures, the mechanism for causing the pawl 29, to be lifted is arranged directly below the heel reinforce fashioning cylinder 17, see Fig. 6. Having fulcrumed relation as at 67, with the bracket 32, which carries the sprocket wheel 38, is a lever 68. The underside of the lever 68, is provided with a lug or projection 59, which lies in the path of travel of the buttons 46, of the sprocket chain 39, so that as a button 46, contacts with the lug or projection 59, the free end of the lever 68, is raised, a spring 60, being present to return the lever to place when a button 46, leaves the projection 59, of the lever 68. Arranged above the fashioning cylinder 17, in any appropriate manner is a pulley 61, and connecting with the pawl 29, and the free end of the lever 68, is a flexible connection 62. Thus, as the free end of the lever 68, is elevated, the pawl 29, is caused to engage the toothed periphery of the fashioning cylinder 17, and as the free end of the lever 68, is drawn to normal position by the spring 60, the pawl 29, is lifted free of the toothed periphery of said cylinder. Otherwise, the construction and operation of parts are similar in all respects to the machine hereinbefore described.

The reinforce 55, fashioned in accordance with either of the above described attachments is of generally tapered, symmetrical contour and may be extended to a considerable height at the back of a stocking without being conspicuous which is obviously advantageous.

What I claim is:

1. In a feed control attachment for straight bar knitting machines making full fashioned stocking webs with selvage edges, the combination of knitting mechanism for forming wales and courses, carrier bars and complemental thread carriers of which at least some of said thread carriers are for supplying heel reinforcing thread, a pattern chain, stop mechanism embracing a unitary structure equipped with a covering, said covering being provided with a central toothed portion and a stepped formation at each end thereof, said stop mechanism operatively disposed in the path of travel of the carrier bar having the reinforce thread carrier thereon for increasing the stroke of said carrier bar to fashion a heel reinforce, the ends of the courses of which define a line inclined to the wales and courses of the stocking web, pawling means for continuously driving said stop mechanism and independent means under control of the pattern chain for limiting said driving means.

2. In a straight bar knitting machine, knitting mechanism, oppositely disposed carrier bars equipped with thread carriers, a pattern chain, a stop member embracing a cylinder having a concentric covering operatively mounted between the opposed ends of said bars the opposite side walls of said covering each having means formed therein of a continuous step-like contour to afford lengthened step by step strokes of said carrier bars, means for continuously driving said stop member, and means under control of the pattern chain for limiting said driving means.

3. In a straight bar knitting machine, knitting mechanism, oppositely disposed carrier bars equipped with thread carriers, a pattern chain, a pattern drum provided with a concentric covering operatively mounted between the opposed ends of said carrier bars, the opposite side walls of which covering each have formed thereon a continuous series of notches of step-like formation to afford lengthened step by step strokes of said carrier bars, means for continuously driving said drum, and means under control of the pattern chain for limiting said driving means.

4. In a straight bar knitting machine, knitting mechanism, oppositely disposed carrier bars equipped with thread carriers, a pattern chain, a pattern drum provided with a concentric covering, rotatably mounted between the opposite ends of said carrier bars, said covering having a toothed periphery and notched side walls of step formation, which notched portions determine the length of strokes of said bars, pawling means for continuously driving said drum and independent means under control of the pattern chain for limiting said driving means.

5. In a straight knitting machine, knitting mechanism including a complemental carrier bar and thread carriers, a stocking heel reinforce fashioning cylinder provided with a concentric covering having a toothed periphery, said cylinder being rotatably mounted in the path of travel of the carrier bar and so designed that in its rotation, the stroke of the carrier bar is lengthened in a step by step movement, a pattern chain, pawling mechanism for operating the cylinder and means under control of the pattern chain for limiting the pawling mechanism.

6. In a straight knitting machine, knitting mechanism including a complemental carrier bar and thread carriers, a stocking heel reinforce fashioning cylinder provided with a concentric covering, having a toothed periphery, said cylinder being mounted for intermittent movement in the path of travel of the carrier bar and so designed that in its rotation, the stroke of the carrier bar is lengthened in a step by step manner, cam actuated pawling mechanism operatively engaging the toothed periphery of the cylinder covering, a tiltable lever, cam actuated mechanism for tilting said lever, and means operatively disposed between the free end of said lever and the pawl for limiting the pawling mechanism.

7. In a straight knitting machine, knitting mechanism including a complemental carrier bar and thread carriers, a stocking heel reinforce fashioning cylinder, having a concentric covering provided with a toothed periphery, said cylinder being mounted for intermittent movement in the path of travel of the carrier bar and so designed that in a complete revolution thereof, the stroke of the carrier bar is lengthened step by step, cam actuated pawling mechanism for operatively engaging the toothed periphery of the cylinder covering, a tiltable lever, an operatively mounted chain provided with projections for successively engaging said lever to tilt it, cam actuated mechanism for operating the chain and means operatively disposed between the free end of said lever and the pawl of the pawling mechanism for limiting said pawling mechanism.

8. A pattern drum of the class stated embracing a cylindrical member adapted for rotation, and a concentric covering therefor, the opposite side walls thereof each having formed thereon means of step-like contour and the peripheral face thereof being toothed intermediate the pair of said step formations.

9. A pattern drum of the class stated embracing a cylindrical member adapted for rotation and a concentric covering therefor, the opposite side walls thereof each having formed thereon means of continuous step-like contour and the peripheral face thereof being continuously toothed intermediate the pair of step formations upon said side wall.

10. A pattern drum of the class stated embracing a cylindrical member capable of being rotated, and a concentric covering therefor, the opposite side walls thereof each having formed thereon a continuous series of notches of step formation and the peripheral face thereof having a continuous series of teeth thereon disposed intermediate said notched sides, one of said teeth being a blank tooth.

11. In a straight bar knitting machine, knitting mechanism, operatively disposed carrier bars equipped with thread carriers, a pattern chain, stop mechanism embracing a unitary structure operative for rotative movement, said structure being equipped with a covering having a stepped formation at each end thereof to afford lengthened step by step strokes of the carrier bars, means cooperatively disposed with respect to said unitary structure for continuously driving the same and means under control of the pattern chain for limiting said driving means.

In testimony whereof, I have hereunto signed my name in the presence of two witnesses.

RICHARD ERNST SCHLETTER.

Witnesses:
WILLIAM J. JACKSON,
AGNES E. CASKEY.

596

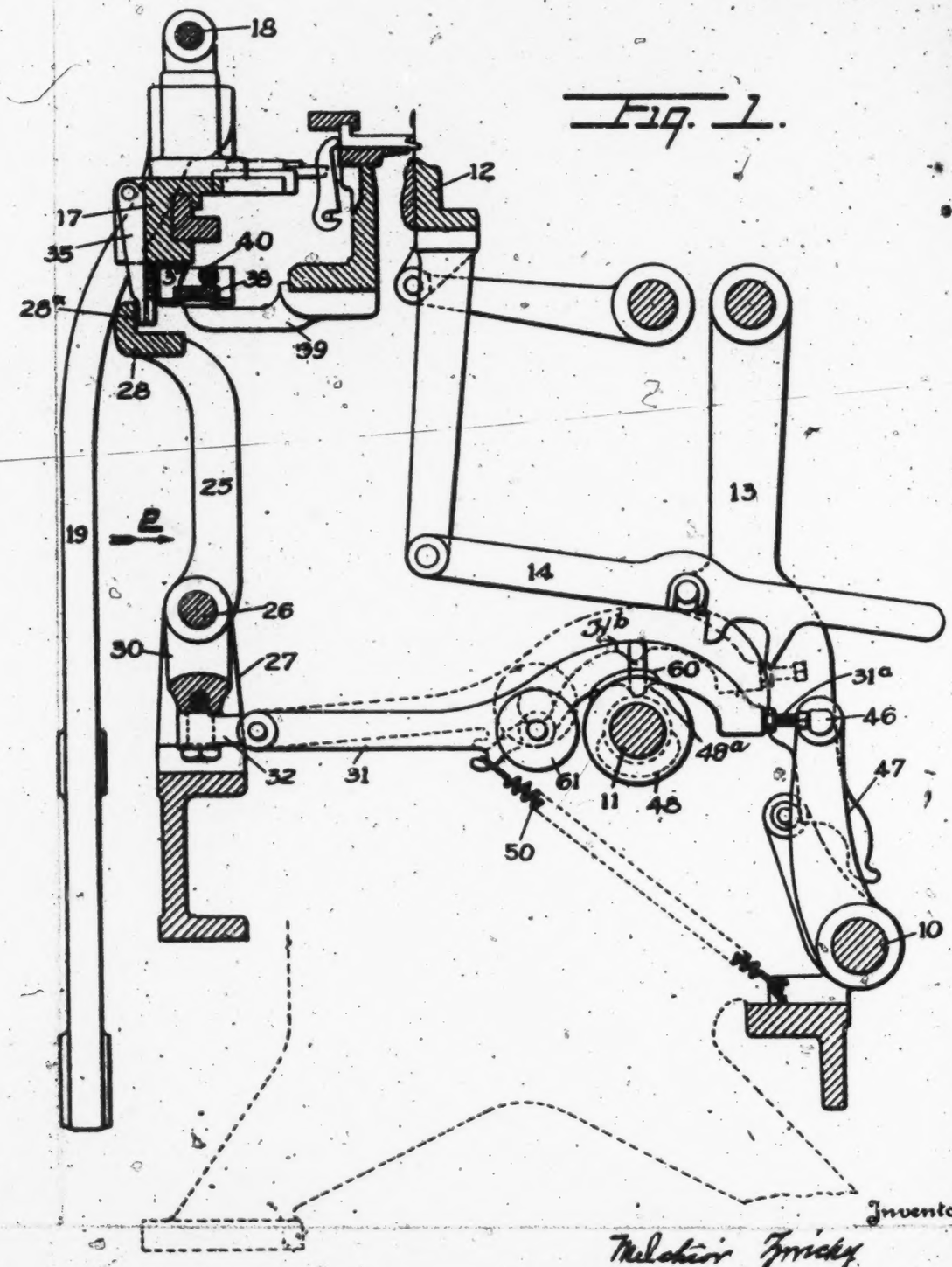
Nov. 23, 1926. 1,608,285

M. ZWICKY

LOOP REGULATING MECHANISM FOR FULL FASHIONED KNITTING MACHINES

Filed July 21, 1923 3 Sheets-Sheet 1

Fig. 1.



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Nov. 23, 1926. 1,608,285

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LOOP REGULATING MECHANISM FOR FULL FASHIONED KNITTING MACHINES

Filed July 21, 1923 3 Sheets-Sheet 2

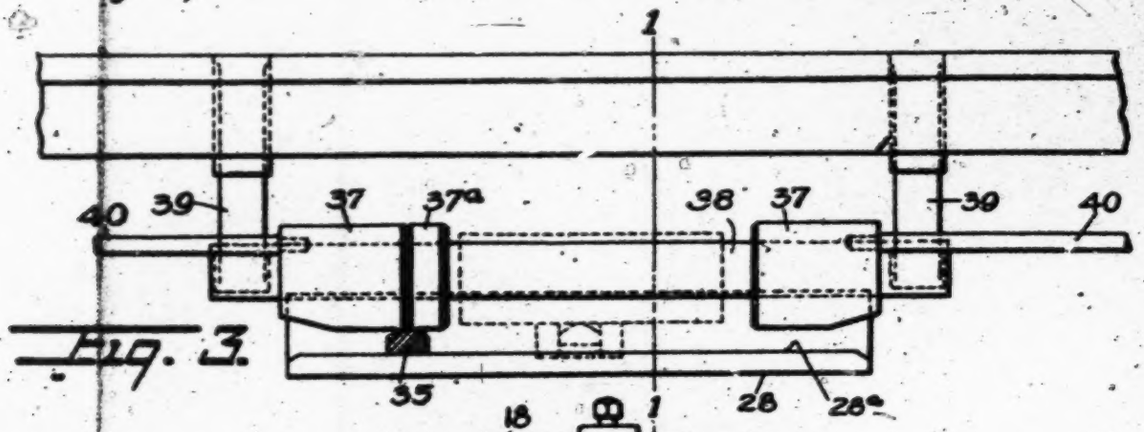

Fig. 3.

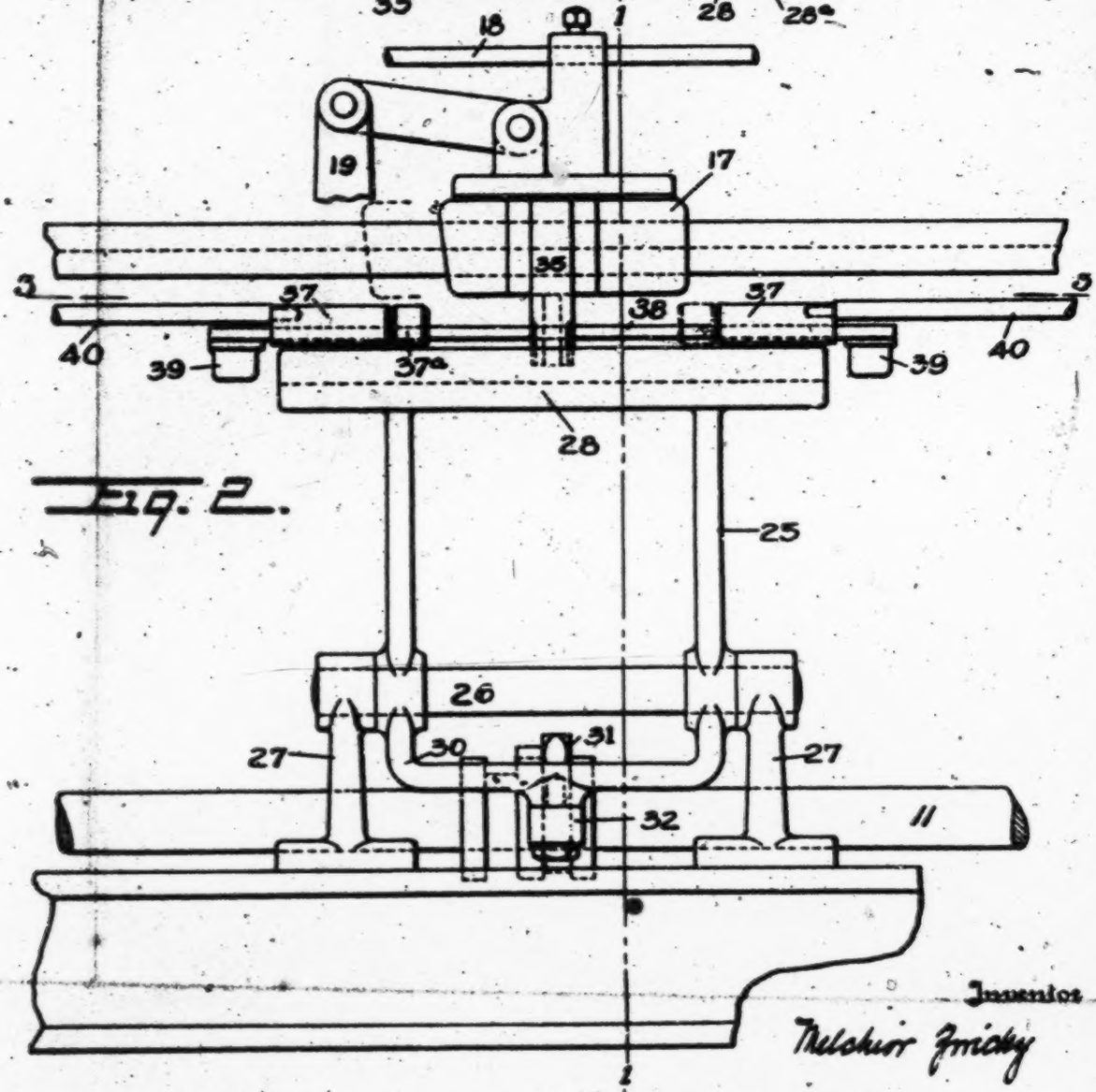

Fig. 2.

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Nov. 23, 1926. 1,608,285

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LOOP REGULATING MECHANISM FOR FULL FASHIONED KNITTING MACHINES

Filed July 21, 1923 3 Sheets-Sheet 3

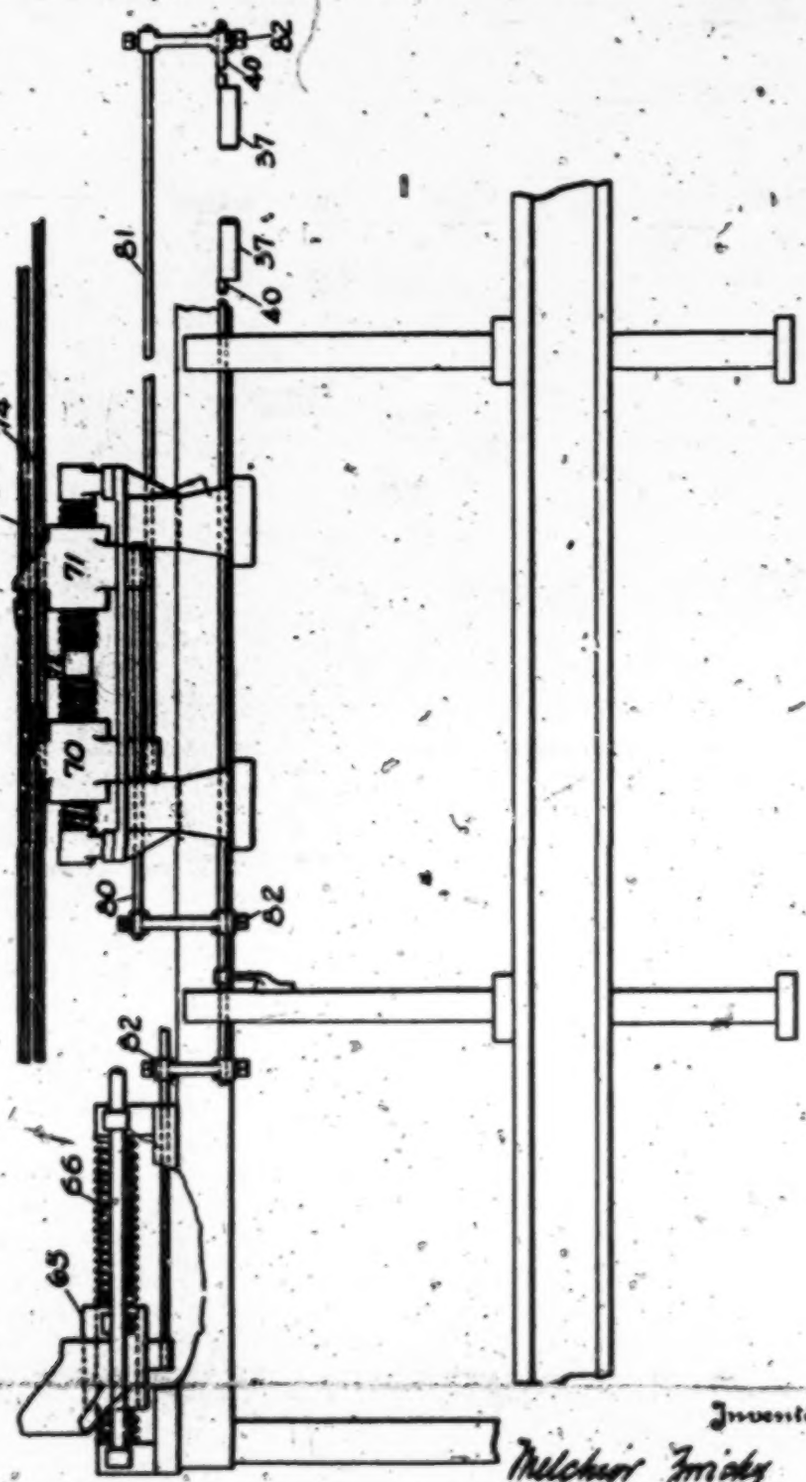

Fig. 4.

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Patented Nov. 28, 1922. 1,436,285

UNITED STATES PATENT OFFICE.

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LOOP-REGULATING MECHANISM FOR FULL-FASHIONED KNITTING MACHINES.

Application filed March, 1922. Serial No. [illegible].

My invention relates to full fashioned knitting machines, and particularly to improved loop-regulating mechanism therefor, as fully set forth in connection with the accompanying drawings, and the novel features of which are clearly defined in the subjoined claims.

Fig. 1 is a cross-sectional view of a full fashioned knitting machine having my invention applied thereto in preferred manner; the well known machine mechanisms employed being sufficiently indicated to make clear the cooperative arrangement, and the cross-section shown being on the line 1—1 of Figs. 2 and 3.

Fig. 2 is a view looking in the direction of arrow 2 Fig. 1, showing the particular attached mechanism employed to carry out my invention; and Fig. 3 is a corresponding plan view thereof on the line 3—3 of Fig. 2.

Fig. 4 is a partial front elevation of an end portion of the machine indicating one of the usual end narrowing screws and a special yarn-stop screw and carrier rods, with selective connections to my improved loop-regulating mechanism.

The drawing indicates well known needle-bar presser mechanism in connection with which my present invention is illustrated as providing a supplemental operating means adapted to independently effect loop-regulating adjustments for lengthening the loops where a reenforcing or plating thread is used; such adjustments being effected from a longitudinally reciprocated member of the usual yarn-control mechanism, without interfering with the loop-regulating movements ordinarily imparted thereto from the cam shaft.

The known needle-bar presser mechanism indicated comprises loop-regulating shaft 10, to which known cam-determined turning movements are imparted from the cam shaft 11 (as shown for instance in my prior Patent No. 1,417,269, May 23, 1922) and transmitted to the pivotally carried needle-bar 12, through presser lever 13 and connection 14; such known movements being used, as is the supplemental movement provided for by my present invention, for variedly positioning the needle-bar relative to the sinkers, so as to correspondingly vary the lengths of the loops formed in the yarn laid by the carriers. Such incompletely illustrated mechanism is commonly used in "Jetton" machines (Pat. No. [illegible]), as is also yarn-control mechanism comprising the indicated longitudinally reciprocated slide bar 17 with its finger-bar and its operated as usual by the [illegible] lever 19 to actuate the yarn-carrier rods and the loop-forming sinkers; and the carrier rod stop mechanisms for controlling the usual yarn travel during ordinary and narrowing knitting. The present invention merely provides in connection with these commonly used mechanisms, additional loop-regulating means as hereinafter fully described.

In the construction indicated the cam shaft 11 is employed as heretofore to control positionings of the needle-bar 12 by means of selectively operating cams thereon, not illustrated; my present invention being adapted to effect additional positionings for slightly increasing the lengths of determined loops which receive an extra yarn, as for instance in forming a determined heel high-splice or a selvage reenforcement.

As illustrated the laying of an extra thread to determined needles only is commonly controlled in well known manner by either the usual narrowing screw nut 65 or special stop nuts 70—71 indicated in Fig. 4, which nuts act to determinedly stop the yarn-carrying rods. Such nuts are also utilized in my improved mechanism to correspondingly control the additional loop-lengthening action which is derived from the longitudinally reciprocated member 17 through my supplemental loop-regulating mechanism.

This supplemental mechanism for utilizing the reciprocating movement of the member 17, comprises, as shown, a supplementary presser-frame 25 carried by a longitudinal pivot shaft 26 mounted in main-frame brackets 27, 27 and provided with a rigid top presser-bar 28, and with a depending portion 30 to which a presser-arm 31 is pivotally connected by means of a knuckle-piece 32; the rigid presser-bar 28 being determinedly operated by said reciprocating member 17 as hereinafter described so as to impart a rocking-movement to the presser-frame 25; which rocking movement is determinedly transmitted to the needle bar 12 by the old regulating shaft 10 and presser lever 13 through my interposed mechanism shown.

The reciprocating slide-box member 17 which I utilize to impart the desired special rocking movements to needle bar 12, is provided with a pivotally carried depending wedge-piece 35, the outer face of which is arranged to slidingly bear against the vertical wall 36 of the longitudinal presser-bar 28 as shown most clearly in Fig. 1; and this wedge-piece 35 is pressed outward so as to slightly rock the presser-bar 28 as the inner face of the reciprocating wedge-piece 35 is brought into contact with coacting wedge blocks 37, 37 mounted upon a guide bar 38 firmly supported by center-bed brackets 39, 39. These wedge blocks 37, 37 are automatically adjusted upon the guide bar 38 as described in connection with Fig. 4, and the rocking movement of the bar 28 is transmitted to the loop-regulating shaft 10 and needle bar 12, through a connected arm 31.

The wedge-block devices 37, 37 are secured to separate extension rods 40, 40 which are respectively attachable to the oppositely moving nuts of the yarn-stop screws—as indicated in Fig. 4 and hereinafter further described—so as to be automatically positioned relatively upon their guide bar 38 in accord with the positions of the connected nuts and the yarn-feed fingers controlled by the latter. In connection with the adjustable devices 37, 37 an extension portion 37ª is provided between them so as to be moved to and fro ahead of the depending wedge piece 35 of reciprocating member 17. This extension device 37ª is employed to insure proper cooperation with the usual sinker-operating slur-cock which is reciprocated with member 17; its length corresponding with that of the straight-face part of the slur-cock, and its movement on the guide bar 38 adjusting such length successively to the respective devices 37, 37 as will be understood to be practically required because of the reverse movements of the slur-cock.

The pivoted presser-arm 31 of presser-frame 25 is provided at its forward end with an adjustable contact point 31ª for engaging the opposed face of a contact stud 41 in the regulating shaft arm 42, to thereby impart a turning movement to said shaft when the presser-frame is raised by the reciprocating member 17. Said arm 31 has a projection 31ᵇ which rides upon the periphery of a special cam 43 on the cam shaft 11 so as to hold the point 31ª in normal position above the contact stud 41 excepting when said depression 43ª presents at the latter to permit operative position by spring 30. During the inoperative positioning of the point 31ª the ordinary turning movements may be freely imparted to the loop-regulating shaft 10 from cam shaft 11 (by usual cams not shown); and any special mechanism for imparting additional turning movements thereto from reciprocating member 17 through the pivotally carried member 35 acts only when contact point 31ª is lowered by cam 43 as stated. To provide that the lowering movement may freely occur the arm 31 is preliminarily moved longitudinally by a cam projection 30 on shaft 11; said projection engaging an anti-friction roller 31 adjustably fixed to said arm 31.

The lengthening of the particular loops through which an extra yarn is to be drawn, is effected by correspondingly moving the needle bar 12 rearward for the periods only during which said yarn is being carried to and formed by the determined needles and sinkers; so that it is necessary in utilizing the uniformly reciprocated member 17 to properly effect such periodic movements of the needle bar, to make its movements effective upon the presser-frame 25 only during corresponding periods of each reciprocation; and where the periods are required to vary in different courses, either in correspondence with the narrowing of the fabric as in the knitting of a reenforced selvage edge or in desiredly shaping a reenforcement or plating, it is practically essential that the spacing of the devices 37—37 which effect the lengthening of the loops, be automatically varied accordingly through the connecting rods 40, 40.

In Fig. 4 I have diagrammatically indicated these devices 37—37, in connection with two different ways of automatically adjusting the same through their connecting rods 40, 40. To effect their automatic spacing in accord with the narrowing of the fabric, one device 37 has its rod 40 operatively connected to the usual stop nut 65 on screw 66, while the other is similarly connected to a stop nut at the opposite end of the machine (not shown). If it is desired to effect an automatic adjustment of the loop-regulating devices 37—37 irrespective of the narrowing of the fabric, these devices are connected to independent operating means; as indicated by the reversely traversed nuts 70—71 on the intermittently rotated screw 72; each of these nuts being operatively attachable, (as through rods 80, 81), to the respective devices 37, 37 instead of connecting the latter to the stop nuts 65, as previously set forth. The reversely traversed nuts 70, 71 also control the travel of the extra yarn-carrier rods 73, 74 in well known manner, and either these nuts, or the stop nuts 65 may be selectively used by tightening or loosening the set screws 82, 82 to automatically adjust the devices 37 in accord with the yarn feed.

My invention thus provides for controlling the loop lengths directly from the reciprocating yarn-feed mechanism and in accord with the laying of the yarn, irrespective of the operations effected from the cam shaft

11. The mechanism specifically set forth may be readily modified within the scope of the invention as defined in the claims.

What I claim is:

1. In a full-fashioned knitting machine, the combination with yarn-control mechanism comprising a longitudinally reciprocated member, needle-bar presser mechanism and a rotary cam shaft operative upon the latter; of supplemental operating means for said presser mechanism actuated by said reciprocative member, and a cam on said shaft adapted to determinedly make said supplemental operating means ineffective.

2. In a full-fashioned knitting machine having a rotary cam shaft, yarn-carrier mechanism comprising a longitudinally reciprocated yarn control member, and a needle-bar presser mechanism operative by said cam shaft; supplemental needle-bar presser mechanism operated by said reciprocated yarn-control member.

3. In a full-fashioned knitting machine having a rotary cam shaft, yarn-carrier mechanism comprising a longitudinally reciprocated yarn control member, and a needle-bar presser mechanism operative by said cam shaft; supplemental operating means for said presser mechanism actuated by said reciprocated yarn-control member.

4. In a full-fashioned knitting machine having a rotary cam shaft, yarn-carrier mechanism comprising a longitudinally reciprocated yarn control member, and a needle-bar presser mechanism operative by said cam shaft; supplemental operating means for said presser mechanism actuated by said reciprocated yarn-control member, and cam-shaft means for rendering said supplemental means operative or inoperative.

5. In a full-fashioned knitting machine comprising a needle-bar and presser mechanism therefor, yarn-carrier rods and stop nuts therefor, and a longitudinally reciprocated yarn-control member; a supplemental presser member operated by said reciprocated member, and devices movable with said stop nuts to vary the operation of said supplemental presser member.

6. In a full-fashioned knitting machine comprising a needle-bar and presser mechanism therefor, extra yarn-carrier rods with special stop-nuts therefor, and a longitudinally reciprocated yarn-control member; a supplemental presser member operative by said reciprocated yarn control member, and movable devices for varying such operation connected to said special stop nuts.

7. In a full-fashioned knitting machine, the combination with yarn-control mechanism comprising stop nuts and a longitudinally reciprocated member; of loop-regulating mechanism comprising a needle-bar presser member operated by said reciprocated yarn-control member, and devices movable with said stop nuts to determinedly vary said operation.

In testimony whereof I affix my signature.

MELCHIOR ZWICKY.

DEFENDANT'S EXHIBIT Q

743

A.D. 1837 . . . . . N° 7476.

Machinery for Knitting Stockings, &c.

MATHER'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, JOSEPH BIRCH MATHER, of the Town and County of the Town of Nottingham, Mechanic and Setter up of Hosiery Frames, send greeting.

WHEREAS Her present most Excellent Majesty Queen Victoria, by Her Royal Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Fourteenth day of November, in the first year of Her reign, and in the year of our Lord One thousand eight hundred and thirty-seven, did, for Herself, Her heirs and successors, give and grant unto me, the said Joseph Birch Mather, Her especial licence, full power, sole privilege and authority, that I, the said Joseph Birch Mather, my executors, administrators, and assigns, or such others as I, the said Joseph Birch Mather, my executors, administrators, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick-upon-Tweed, my Invention of "CERTAIN IMPROVEMENTS IN MACHINERY EMPLOYED IN MANUFACTURING HOSIERY GOODS, OR WHAT IS COMMONLY CALLED FRAME WORK KNITTING;" in which said Letters Patent is contained a proviso obliging me, the said Joseph Birch Mather, by an instrument in writing under my hand and seal, particularly to describe and ascertain the nature of my said Invention, and in what manner the same is to be performed, and to cause the same to be inrolled in Her said Majesty's High Court of Chancery within six calendar months next and immediately

after the date of the said in part recited Letters Patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said Joseph Birch Mather, do hereby declare that the nature of my said Invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following description thereof, reference being had to the Drawings hereunto annexed, and to the letters and figures marked thereon (that is to say):—

My improvements in machinery employed for manufacturing hosiery goods or frame work knitting apply to that class or description of machinery well known as the "stocking frame," or what is commonly employed for making stockings, knitted gloves, caps, ladies' scarfs, and such like goods or fabric formed of silk, cotton, or linen thread or yarn, and consist,—

Firstly, in constructing and arranging the various working parts of the machine or stocking frame, so that two, three, or more rows, tiers, or sets of stockings, gloves, or other work may be made or manufactured at one time, one above the other, in the same frame or machine, the working parts, such as the "rows of needles," "thread carriers," "pressers," &c., being multiplied according to the number of rows or tiers of work intended to be made in one frame or machine. The "sinkers" or parts which depress the thread and carry it between the "needles," being also increased in the same way, although they are each formed of one piece of metal and suspended from and worked by one set of "jacks" or levers, with the "jack springs," &c.

Secondly, in improved constructions and arrangements of mechanism or apparatus for conducting, carrying, or traversing the thread across the machine from side to side of the work, with suitable improved mechanism for determining the extent of motion of the "thread carriers," that is, effecting the shortening or lengthening of their traversing motions for the purpose of conducting the thread over a more or less number of "needles," and consequently producing narrower or wider work, as is required for the calf or the small of the leg or ancle of the stocking, together with suitable apparatus or mechanism for effecting the "heeling" of the stocking, or dividing the making the fabric at this time into two, three, or more parts. And, further, in an improved manner or method of supporting the "jack frame," it being supported by means of rocking or pendulous levers so as to allow of its required advancing and retiring motion instead of the ordinary truck carriage running upon the rails or "table bars" as in common. And also in improved mechanism or

apparatus called "pressers," for depressing the beards of the needles and closing them upon the thread at the required time, such pressers being separate or independent from each other, in contradistinction to the ordinary solid blade or presser bar, whereby I am enabled to select any one, two, three, or more of the pressers and throw them out of work and put them in again as required in making fancy goods or worked patterns. And, moreover, I am enabled to apply to the machine or stocking frame the mechanism or apparatus known in the silk loom or weaving of fancy silk goods as the Jackguard box or cylinder with its pierced cards, together with suitable apparatus or mechanism for acting upon these improved pressers in order to throw them into and out of work as required; together with an improved manner, mode, or method of applying the "jack springs" adapted to the jacks or levers which carry the sinkers, for the purpose of obviating the friction and consequent wear in the jacks and other parts by the ordinary mode of adapting the springs, and also preventing the liability of the tails of the "jacks" jumping out of the notches or cramps of the jack springs at the time of the sinkers being depressed, which evil is frequent in the ordinary stocking frame. And,

Thirdly, in the application and adaptation of the above-named mechanism called the Jackguard cylinder or box, revolving with its pierced cards, to the stocking frame or machine, such Jackguard cylinder or box being placed in suitable framework and bearings, with proper mechanism for giving and governing or regulating its motions, the pierced cards being brought opposite the ends of the pressers, or sliding rods, or levers, or fallers connected with and adapted to the said Jackguard mechanism and the above-named presser in such a manner that when the pierced holes of the cards or plates are brought opposite and presented to the ends of the pressers, sliding rods, levers, or fallers, they shall be made to enter the holes by means of suitable springs or mechanism, so as to act in conjunction with particular pressers, and thereby throw them out of work, while the machine or frame is going through its regular and ordinary motions, so as to produce by such withholding of the action of the pressers, fancy work in the piece or goods; at the same time the remainder of the pressers not so acted upon shall go through their regular or ordinary movements and operations, and produce the ordinary work; all of which will be fully understood by inspection of the accompanying Drawings, and the following description of the mechanism, the several Figures being different views of a stocking frame with my improvements applied thereto, together with separate or detached Figures of some parts; the old or ordinary parts of the machine being shewn in outline only, and marked

with capital letters or characters, and the new or improved parts being coloured with different tints over the various parts of different motions; the thread carrier for plain work and its assistant parts being tinted red, those for the side pieces of the heeling operation blue, the pressers and their component parts yellow, the sinkers, jacks, halfjacks, and the jack-springs green, and the parts for suspending or supporting the jackframe brown, and marked with small italic letters and figures of reference. And as the various ordinary working parts of the stocking frame, together with their motions to produce the knitted fabric, are well understood by all practical workmen or competent mechanics, it will not be necessary for me, in describing my improvements, to enter into the detail thereof further than to shew the operation of the same; and I shall, therefore, first point out and name the old or ordinary parts, and then proceed to describe my improved machinery or apparatus connected therewith.

Figure 1 is a front view of a stocking frame, with my improvements applied thereto, shewing the various parts in the situation they are in while the thread carrier is conducting the thread across the machine and laying it upon the needles, and when making plain in one piece as the leg of a stocking, the "thread carriers" for working the two side pieces of the heeling part of the stocking being turned up out of the way of the workman. Figure 2 is a vertical section taken transversly through the machine. Figure 3 is a plan view; Figure 4 is a back view; and Figure 5 is a partial plan view or section taken in the dotted line *a*, *b*, Figure 2, shewing the mode or mechanism of lifting the thread carriers when they are about to lay the thread. Figure 6 is a partial vertical cross section full size, shewing the arrangement of the sinkers, needles, and pressers, and the mode or manner of letting the "thread carriers" fall when they have laid the thread. Figure 7 is a front view of the same. Figure 8 is a partial vertical section of the "jackframe" drawn full size, shewing the "halfjack," the "jackwire" or fulcrum of the jacks, and my improved mode or manner of applying and adapting the "jacksprings" to the "jacks" or levers which support the "sinkers." A, A, is the ordinary framing and framework of the machine or stocking frame; B, B, are two rows or tiers of bearded needles fixed on the needle bars C, C, in the usual manner, they are placed one row above the other so as to make two rows or tiers of work; D, D, are the "sinkers," one half of which (the "lead sinkers") are mounted on the "sinker bar" E as usual, and the other half are jointed at their upper ends to the "jacks" as in common, and for a machine or frame intended to make only one row of work the sinkers would be found like ordinary sinkers, but by my improvements they are elongated for the purpose

of having the other row or second tier of sinkers or hooked depressing parts formed on them for the lower row or tier of work; F, F, are the "jacks" mounted on the jack pin or fulcrum, which is placed in the jack frame G in the ordinary manner; H are the back jack guides or sled; I is the "jack falling bar;" K is the "slur cock" and its slur bar or race; L is the "locking bar" of the jacks; M is the slur wheel for giving motion by bands and pulleys to the slur cock as usual, and also to the thread carriers, and is worked by the treddles N, N, in the usual way.

The Thread Carriers and their Motions and Operations.—The thread carrier for plain work *a*, *a*, are attached to the arms *b*, *b*, which project from the sliding piece or rest *c*, *c*, to which they are attached by hinge joints, as shown in the Drawing; the pieces *c* are mounted upon a triangular (or other shaped) bar *d*, so as to have a free sliding motion along the bar; *e*, *e*, are notched tail pieces projecting from the sliding piece *c*, and when the thread carriers arrive at either end of their motion, the part 1 of these tail pieces comes against the inclined plane 2, 2, on the short tubular pieces *f*, mounted sliding on the rod *g* (see the detached Figure 9), and thereby forces that bar backwards or further from the bar *d*, and thereby releases that bar and the thread carriers by withdrawing the catches 3, 3, from the tail pieces 4, 4, (see Figure 6), when the thread carriers immediately fall below the needles. The bar *g* is supported by brackets 5, 5, from the swinging bar 41. The tubular pieces *f* are embraced by the forked clutches *h*, *h*, attached to the sliding pieces or female screw boxes *i*, *i* (see the detached Figure 10), working upon the male screws *k*, *k*, and it is by these parts that the widening or narrowing motion is effected, for, according to the distance the inclined planes 2, 2, are apart from each other will depend the width of the work, for the thread carriers will be released and fall, and consequently stop laying the thread at whatever point these inclined planes are placed. The notches 7, 7 (Figure 6), are formed in the tail pieces merely for the purpose of allowing them to pass over the hooked pieces 8, 8, which are there placed for the purpose of holding the tail pieces steady while the slur is being taken up. In order to allow of the thread carriers being moved out of the way of the workman, when he wishes to alter or adjust his work, the arms *b* are jointed to the sliding pieces *c*, and are kept in their proper position by means of adjusting screws and springs, as shown in the Drawing. And I would here observe, that the thread carriers for the side pieces of the heels of stockings, or such other parts of work, are merely a repetition of all the parts belonging to those for plain work, and they are therefore marked with the same references, with the addition of an *. These second thread carriers are shown in the Drawings as turned up out of the

way, as when making plain work, they being jointed by the arms b^* to the sliding pieces c^*; but when they are required to work they are turned down into a similar situation as the first thread carrier. All these carriers being supplied with yarn or thread from bobbins or spools placed above in the usual way, the requisite motion of the thread carriers across the machine is obtained from the ordinary slur cock motion by elongating the shafts of the slur cock pulleys, as shewn in the plan view, Figure 3. Upon the end of these shafts are placed the pulleys *l*, *l*, over which shaft is passed the endless cord or band *m*, *m*, which is attached to the sliding piece *c*, upon the angular bar *d*, and thus the requisite and proper motion of the thread carrier is obtained by the workman effecting the slur cock motion, which is the required time for performing its proper operations; but in order to prevent the slur cock or rather the falling motion of the jacks overtaking or following too near the thread carrier, the pulleys *l*, *l*, are larger than the slur cock pulleys, so that the thread carriers are always in advance of the slur cock by means of their quicker motion; and I would here observe, that although I have shewn the pulleys *l* as adapted to drive all the thread carriers, if it may be thought desirable, additional pullies may be worked by the slur wheel for the purpose of driving the heeling carriers only. The angular or other shaped bars *d*, *d*, are attached at their ends to the upper parts of the vertical rods or levers *n*, *n*, which are mounted, turning on fulcrum or screw pin joints at *o*, *o*, on the ends of the lever arms *p*, *p*, of the rocking bars or rods *q*, *q*. These bars are also furnished with centre pins as fulcrums (as shewn in Figures 2 and 5, placed in any convenient manner in the "hanging cheek" of the frame, and have other arms or levers *r*, *r*, projecting therefrom. The ends of these arms are acted upon by other levers or arms *s*, s^*, extending from a sliding bar *t*, placed in suitable guides and furnished with a returning spring at one end, and at the other with an anti-friction roller working against and acted upon by the pieces or tappets *u*, *u*, placed on the side of the ordinary "slur wheel." These arms or levers *s*, *s*, are moved by the tappets *u*, in the direction of the arrow (Figure 5) so as to stand in the way of the ends of the levers *r*, r^*, only at such time as the thread carriers are required to be raised to lay on the thread, and they are thereby kept up during the laying on of the same. *v*, *v*, are inclined plane pieces fastened on to the hanging bars or levers *n*, *n* (see Figure 2), and moving with these bars through staples or guides *w*, *w*, fixed on to the ordinary "hanging cheek" of the frame, and are placed for the purpose of guiding and bringing the thread carriers in their proper motion towards the needles when they are advancing or retiring from them. *x* is a guide or stop piece acting against the edge of the triangular bar *d* of

the thread carriers when the sinkers are down, for the purpose of keeping the thread tight and preventing any slackening so as to make a good and perfect selvage to the piece.

The Narrowing and Widening Motion of the Thread Carriers.—The narrowing and widening of the motion of the thread carriers is effected in the following manner:—The female screws *i*, *i*, work upon the right and left-handed male screws *k*, *k*, which are formed upon the same shaft and turn in proper bearings and centre pins in the framework. Y, Y, is a stationary guide bar, serving for both of the female screws, for the purpose of keeping them in their proper motion, and preventing their turning round with the shaft. Upon the end of the screwed shaft *k* is placed the ratchet wheel 16, which has a partial rotatory motion given to it at the time required, by the following means:—(See the enlarged views, Figures 6 and 7) where this motion is shewn applied to the heeling screw, the ratchet wheel for driving the other or middle work screw being at the contrary end of the machine to that represented in these Figures. 17 is a handle or lever turning upon the shaft, and is furnished with a clawker 18, taking into the teeth of the ratchet wheel 16. 19 is a safety spring pall or ratchet wheel retaining the wheel and preventing any returning motion until it is lifted out of its teeth. When the workman wishes to narrow his work, he has to take hold of the handle 17, and and drawing it towards him, causes the ratchet wheel, by means of the clawker, to turn part of a revolution, and thereby to turn the screws *k*, *k*, and consequently cause the female screw boxes *i*, *i*, to advance towards each other, sliding upon their guide bar y. When the workman has finished a piece of work he releases the pall 19 from the ratchet wheel, and turns the ratchet wheel round by hand the reverse way, and consequently forcing the female screws apart from each other to the full extent ready to begin a fresh piece of work.

The Jack Springs, Jacks, and Sinkers.—The improved manner or method of applying the jack springs to the jacks is shewn best in Figure 2, and at full size at Figure 8. F° is the ordinary half jack turning upon the jack pin as its fulcrum; to the "half jack" is attached the bent arm or lever 10, which carries at its other end the jack spring bar 11, into which the jack springs 12, 12, are fixed in the usual manner. It will be seen by inspecting the Drawings that as the jack springs are placed on an arm attached to the half jack they will make a corresponding motion to the tails of the jacks themselves as they rise and fall during the time the machine or frame is going through its motions, the jack springs rising and falling with the tails of the jacks, and thereby preventing the friction caused by the ends of the jacks rubbing against the ordinary springs. The bent part of the springs at 14

hold the ends of the jacks and keep up the sinkers by pressing upon the top part of the ends of the jacks, but when the sinkers are down the springs keep them in that position by means of the inclined parts 15, 15, of the springs pressing inwardly against the under side or inclined part 16 of the ends of the jacks, thereby keeping them down and preventing them from rebounding; and by avoiding the friction caused by the old or ordinary method of constructing and applying the springs gives much less labour to the workman in working the frame. F, F, are the jacks. D, the sinkers, the motions or movements of which are the same as in ordinary stocking frames, therefore it is not necessary for me here to describe them. The sinkers are elongated for the purpose of having my first improvement applied to them, namely, in order to make the second or lower row or tier of work, and they are furnished with a second or lower guide to move through the same, as is applied to the upper one.

The Pressers and their Motions and Operations.—I shall now proceed to describe the pressers 20, 20, and the method of putting them in motion and operation. They are formed as shewn in the detached views, Figures 12, 13, and are cast into leads in the usual way that guides, needles, and other such other parts usually are, and placed upon the presser rod or bar 21, 21, turning on centre pins placed in the bracket pieces 22, 22, attached to the strong piece 23, which piece supports the lower needle bar C, and is furnished with proper adjusting or set screws 24 underneath the bar for the purpose of adjusting and setting the lower needle bar at the requisite distance from the upper one. To the upper presser bar 21 is connected the bent lever 25, having its fulcrum at 26 in the lever 27, which has its fulcrum at 28. To the other end of the bent lever 25 is attached one end of the link 29, its other end being connected to the lever 27. 30 is an adjustable link piece for the purpose of connecting the two bent levers 25, 25, of the pressers together, and causing the lower one to perform the same motions as the upper one. The lever 27 has its fulcrum in centre pins 28 placed in brackets 32, attached to the bar 33. One end of the lever 27 is connected by the rod 34 to the presser treddle, its other end being attached to the spring 35, which is fastened to the lower part of the framework of the machine or to the floor of the room. By this arrangement of mechanism it will be seen that the two rows of pressers will have the same movements given to them from the presser treddle, and consequently perform the same operations. The points of the pressers which press upon the beards of the needles have a shallow groove formed in them for the purpose of preventing the pressers slipping off from the needles. And in order to prevent the sinkers cutting the work against

the edges of the pressers and indicate to the workman when he has got the work safely over the beards of the needles, the piece 36 is attached to the upper presser bar, and after the work is safely on the beards of the needles, the end of the piece 36, when the workman performs the pressing motion, comes against the hand bar at Q and checks him from drawing the frame further forwards. The work rollers are placed at P, P, and are actuated by weights and cords in the usual manner. In describing the pressers, to prevent confusion I have mentioned only one presser bar to which they are attached in one row, as connected with each row or tier of needles; but it will be evident to all practical workmen that from their nature and form they may be cast in separate leads, or two or three or more upon one lead, with spaces between them, as may be required for different kinds of fancy work, and they may also be fixed upon different presser bars, and acted upon by different cam wheels, levers, or treddles, so as to cause different pressers to come into and out of operation at stated times, so as to produce different patterns of fancy work Also that they may be so mounted singly or independently of each other on one or more fulcrum pins or bars, so that they may be acted upon by levers or other mechanism, and depressed to come into action at the times required and returned by springs or other contrivances placed in conjunction with them. All variations and modifications of which, it is not necessary for me to describe, as any practical mechanic will see their application to these purposes.

Figure 12 shews a side view, and Figure 13 a top view of one lead of these pressers detached.

The Supporting the Jack Frame.—The jack frame, as shewn in the Drawings, is suspended from strong pins at 40, 40, by means of arms or levers 41, 41, attached at the lower ends by pin joints to the jack frame, and at the other to pins 40, which are securely placed in the standards 42, 42, bolted on to the sole bar or framework of the machine. This arrangement of mechanism will allow of a free and easy motion of the jack frame forward and backwards in the machine, without the inconvenience caused by the wear of the wheels in the ordinary way of supporting the jack frame, by running on the sole bar of the common frame. And the same effect may be produced by supporting the jack frame upon rocking levers, having their fulcrum at their lower ends, proper connecting and stop pieces being applied to keep the frame in its proper situation and motions.

Having now particularized the various parts of the mechanism, I will proceed to describe shortly the general operation and working of the same. In the situation of the parts, as shewn in the Drawings (we will suppose the

machine to be making the leg or plain part of a stocking) a course of work has just been completed, and the thread carrier has been raised above the needles in preparation for laying the thread, this raising of the thread carried has been effected at the last motion of the completed course, commonly termed "going over the arch," when the lever tail *r* was brought by the receding of the frame under the arm *s* of the sliding bolt *t*, when the frame rising with its ordinary motion by means of its spring above the lever tail, is kept down, turning the lever arm *p* on its fulcrum in the "hanging cheek" and thus throws upwards the vertical levers *n*, *n*, carrying the triangular bar *d*, and consequently raises the thread carrier above the needles. The parts having arrived in this position, the workman as usual depresses the treddle for the purpose of drawing the jacks by given motion to the slur cock, at which time the thread carrier, by means of its pulley *l* and cord *m*, begins to travel along the bar *d*, laying the thread across the needles in preparation for another course of work; during this motion of the thread carrier, the operation of drawing the jacks has taken place as usual, they following the motion of the thread carrier which has commenced its operation first, by means of the slur cock having a short space to travel on the slur bar before it arrives in contact with the jacks. During this operation of drawing the jacks and laying the thread, the cam or tappet *l*, *l*, has retreated from contact with the antifriction roller of the sliding bolt *t*, which is then forced by means of the spring 43, so as to carry the arm *s* clear of the lever tail *r*, for the purpose of allowing the lever *n* and bar *d* to prepare to fall and carry the thread layer through the needles. Nevertheless, it is necessary that the arm *s* should remain over the lever tail *r* for a short space after the thread carrier has started, in order that the catch 4 may land safely on the hook piece 3, which it cannot do until the part 1 of the thread layer is free from the short tubular piece *f*, when the springs 44 will bring it in safely. The thread carrier having arrived over the space through which it is intended to lay its thread, the tail piece 1 comes in contact with the inclined plane 2 of the short tubular piece *f*, which compels the rod *g* on which it slides to retreat inwardly, which motion of the rod *g* turns the bar 41 upon its centre pin 42, which in so doing throws the hook piece 3 (which is attached by the arm 50 to the bar 41), from under the catch or stop 4 of the slide bar *d*. The hook piece being thus withdrawn from supporting the bar *d*, it descends, and with it the thread layer, carrying the thread between the required needles, the distance that the thread layer shall fall being determined by the adjustable pin 48 and stop piece 49. The workman now sinks the lead sinkers, in doing which the inner part of the fork piece *w* affixed to the "hanging cheek"

comes in contact with the inclined plane v affixed to the lever n, and as the frame descends the inclined plane v forces the lever arm n from the front of the machine, and moves the thread layer forward in order to clear it from the sinkers. The work is as usual now brought forward, and the frame thrown up to the friction trucks 4C, in doing which the projecting piece x, affixed to the locker L, arrives in contact with the bar d, for the purpose of keeping it out when the forked piece n has arrived at a narrow part of the inclined plane v. The workman now depresses the presser treddle which operates as before described, brings the pressers 20, 20, on to the beards of the needles, when the frame is drawn forward, and the work brought over the needles in the usual manner, after which he "sinks the frame," and "goes over the arch," bringing the parts into the position before described, and so on, narrowing the distance between the adjustable stop pieces f to form the requisite shape by means of the mechanism, as before described. During this description of the operation of the machine, I have, for simplicity, not mentioned the effect produced by my improvements in the arrangement of the jack springs, but having before described it, and their construction and combination being particularly shewn in Figure 8, their operation will readily be perceived. The workman having arrived at the instep, the heeling apparatus is brought into operation. To effect this, the female screws i*, i*, and with them their stop pieces f* and f* are brought into the required situation for forming the outsides or narrowed parts of the heels, as at a, a (see the Diagram, Figure 14), and the forked pieces 8**, 8**, adjusted for forming the insides or straight sides b, b. These latter fork pieces are not connected with the screw motion, but are secured to the guide y bar by means of screws, their position not requiring to be varied during the operation of making a stocking. On starting for the heeling the workman places one of the thread carriers over one of the fork pieces 8**, 8**, or that point coincident with the intended strait side of the heel, and the other on the narrowing edge of the other side of the heel, when motion being communicated to the [illegible] they will travel along the bar d*, and that one which is [illegible] towards the outside will strike the inclined plane [illegible] of the [illegible], and thereby throw the lever n* from its support as [illegible], [illegible] will fall through the needles to produce a narrowing. The operation of this part of the mechanism, i. e., the thread layers, is precisely the same as that just described, and as similar letters of reference with the addition of an * are marked on corresponding parts, it will not be necessary to enter into the working of the same. It being understood that as the work proceeds the workman produces the necessary narrowings of the heel or those parts

marked A, A, Figure 14, by shortening the distance between the stops f^*, f^*, and by means of the ratchet wheel and its accompaniments, as before described, the stops f^*, f^*, acting alternately to let the thread carriers fall into the hook pieces 8^*, 8^*, and that the narrowing of the instep or middle part B is effected by the screw boxes *i*, *i*, and stops *f*, *f*, as before described, with reference to the leg. The instep and heeling being completed, the stockings are pressed off at the toes and footed in the usual manner, the thread carriers being brought into operation as before described.

I shall now proceed to describe the last head of my Invention, videlicet, the adaptation of the mechanism, called the Jacguard cylinder or box, with its moving pierced pattern cards or plates to the stocking frame. The outline, Figure 15, represents a partial section of the stocking frame, with these parts of my improvements applied thereto. A, A, are needle bars; B, B, the sinkers; *a*, *a*, the pressers, which are in this case mounted in combs *y*, cast in leads in the usual manner. *x* is a centre pin passing through them and the combs on which they freely turn. At the further extremity of the pressers are tail pieces *b*, *b*, *b*, *b*, *b*, against which the Jacguard cylinder or box is intended to act. *c*, *c*, are connecting links between the top and bottom pressers, to effect the same motion on both tiers when the frame is working with my first improvements, viz., with two or more tiers of operative parts applied thereto. *r* are springs for the purpose of returning the pressers to their upward position. *d* is the Jacguard cylinder or box, turning in bearings in the vertical rod *f*, *f*. *e*, *e*, are the perforated cards or plates passing over the Jacguard cylinder, and from thence to any convenient situation. The vertical rod *f* passes between the stationary parallel guides *g*, *g*. The lower extremity of this vertical rod is connected by a pin to the lever *h*, *h*, which lever turns upon the fixed centre *i*, and is connected at its back end to the presser treddle *c*. *k* is a spring fixed at its upper end to the Jacguard cylinder or box, and at its lower end to any convenient part of the frame. *m*, *m*, is a lever turning upon a fixed centre *n*, and drawn upwards by the spring *o*. *p*, *p*, is a sley for guiding the pressers. The action of the parts is as follows: The workman in the ordinary motion of pressing depresses the treddle *c* as usual, which by its connection with the lever *h*, *h*, will raise the vertical rod *f*, *f*, and with it the Jacguard cylinder or box and its pattern cards, which will then come in contact with the tails *b*, *b*, *b*, *b*, of the pressers *a*, *a*, when those tails which are met by perforations in the Jacguard card or plate will pass freely through such perforations, while those that are met by the solid or unperforated portions of the card or plate will be carried upwards, and their opposite ends perform the usual process of pressing. The effect of this will be, that where no

action is given to the pressers, what is commonly called "tuck fancy work" will be produced. The workman then having brought the work over the beards of the needles and removed his foot from the presser treddle in the usual way, the Jacquard cylinder begins to fall, and is assisted in that movement by the spring *k*, *k*; during this operation one of the pins *p*, *p*, arrives in contact with the top *q*, *q*, when the cylinder will be turned round upon its axis, and having performed so much of a revolution as will bring the point *p*° beyond the centre line, it will be forced round the remainder part of a quarter revolution by the flat spring lever *m*, *m*, which lever will then retain it in an horizontal position, and a fresh card or plate will be presented on the upper surface to be used as before; *r* is a set screw for regulating the fall of the Jacquard box. It will be perceived by inspecting the Drawing that the tails *b*, *b*, *b*, of the pressers are not formed in one continuous line, but are set a short distance from each other for the purpose of gaining space for perforating the Jacquard cards or plates. In order to compensate for the different degree of motion that the pressers would have, owing to their tails being differently situated with regard to their common centre of motion, they are so shortened towards it that their ends shall give an equal pressure upon the needles. It will also be perceived that the connecting links *c*, *c*, are attached to small projecting pieces from the pressers, which may perhaps be thought desirable for the purpose of gaining room for the joint. And I would remark that although I have only shewn one means of applying the principle of this my Invention, it will readily be perceived by all competent persons that many variations may be made in the same without departing from the main object, for instance, the perforated cards or plates may move in a direction lengthways of the machine, receiving suitable and appropriate motions by many mechanical means for bringing a fresh card or plate into operation, and that many other contrivances may be used to effect the motion of the parts which I have described. I would also observe that instead of the ordinary Jacquard, as described above, a barrel with tappets on its periphery or with sunken holes might be used, but in this latter case a separate pressing motion must be obtained to act upon the tails of those pressers which have not sunk into the holes of the cylinder.

Having now described the nature and operation of my improvements, I wish it to be understood that I do not mean or intend to confine myself to the precise shape or form shewn of any of the parts of my new or improved mechanism, as they may be varied to suit the nature of the frame or machine, and the kind of work to be produced, for instance, in a frame of fine numbers I should prefer bringing the stop pieces or inclined planes which determine

the extent of motion of the thread carriers, and consequently the width of the work produced as near as possible to the sliding pieces *c* upon the triangular bar *d* instead of acting upon the end of the tail pieces *e*. And, further, it may be necessary, when a machine is worked very fast as by rotatory or steam power, to strengthen and steady their thread carriers by placing braces or arms, extending from the ends of the pieces *c* to the sides of the middle or lower part of the arms *b*, so as to prevent any vibration caused by the jar of the same when stopping at the end of their motion, all of which will be readily suggested by any practical workman. And, moreover, I do not claim as my Invention any of the working parts or motions of the ordinary machine, although they may appear to be effected somewhat in a different way to that in common; neither do I claim the exclusive use of mechanical thread carriers for conducting and laying the threads across the needles instead of by the hand of the workman, as this has been effected before by certain mechanism or apparatus; but what I claim my improvements and Invention to be, under the first head or section of my improvements, is,—

The constructing, arranging, and forming a stocking frame or machine capable of making or manufacturing two or more rows or tiers of work one above the other, each row or tier having suitable and proper rows of needles, sinkers, pressers, or presser bars, and other parts to perform the same, together with suitable work rollers to take up the work as formed.

And, under the second head, I claim, first, the new or improved arrangement and construction of mechanism herein described, forming the thread carriers for conducting and laying the thread across the needles, particularly the right and left handed screws, and the sliding pieces moving upon and along the angular or other shaped bars *d*, and the mechanism connected therewith for narrowing and widening the extent of the motion of the thread carriers, and consequently the width of the work produced. Secondly, the suspending or supporting the jack frame by means of pendulous or rocking levers instead of the ordinary wheels running upon the sole bar of the common stocking frame. Thirdly, in the construction, application, and adaptation of the pressers placed at the back of the frame, and acting upon the beards of the needles, and as applied to the stocking frame, either in one continuous row, or in different numbers, or singly, together with the mechanism or apparatus for setting them in motion and bringing them to operate upon the beards of the needles. Fourth, in the improved mode or manner of applying and adapting the jack springs to the halfjacks and jacks in the manner and for the purposes herein-before stated.

And lastly, under the third head of my improvements, I claim the applica-

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A.D. 1837.—N° 7476. 15

Mather's Improvements in Machinery for Frame-work Knitting.

tion and adaptation of the Jacguard mechanism above named to the stocking frame or machine, consisting of the Jacguard box or cylinder, with its pierced cards or plates, or such other moving pierced pattern cards or plates, together and in connection with the suitable arrangement and construction of mechanism for giving it motion and connecting or communicating such motions or movements, by means of the intermediate mechanism, to the pressers in order to produce figured ornamental fancy work or knitted fabric.

In witness whereof, I, the said Joseph Birch Mather, have hereunto set my hand and seal, this Twelfth day of May, in the year of our Lord One thousand eight hundred and thirty-eight.

JOSEPH BIRCH (L.S.) MATHER.

AND BE IT REMEMBERED, that on the Twelfth day of May, in the first year of the reign of Her Majesty Queen Victoria, the said Joseph Birch Mather came before our said Lady the Queen in Her Chancery, and acknowledged the Instrument aforesaid, and all and every thing therein contained and specified, in form above written. And also the Instrument aforesaid was stamped according to the tenor of the Statute made in the fifty-fifth year of the reign of His late Majesty King George the Third.

Hunt, Extra.

Inrolled the Fourteenth day of May, One thousand eight hundred and thirty-eight.

LONDON:
Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty. 1857.

DER Q. P.N.

A.D. 1937 Nov 11. N° 31126.
MATHERS Specification.

FIG. 1.

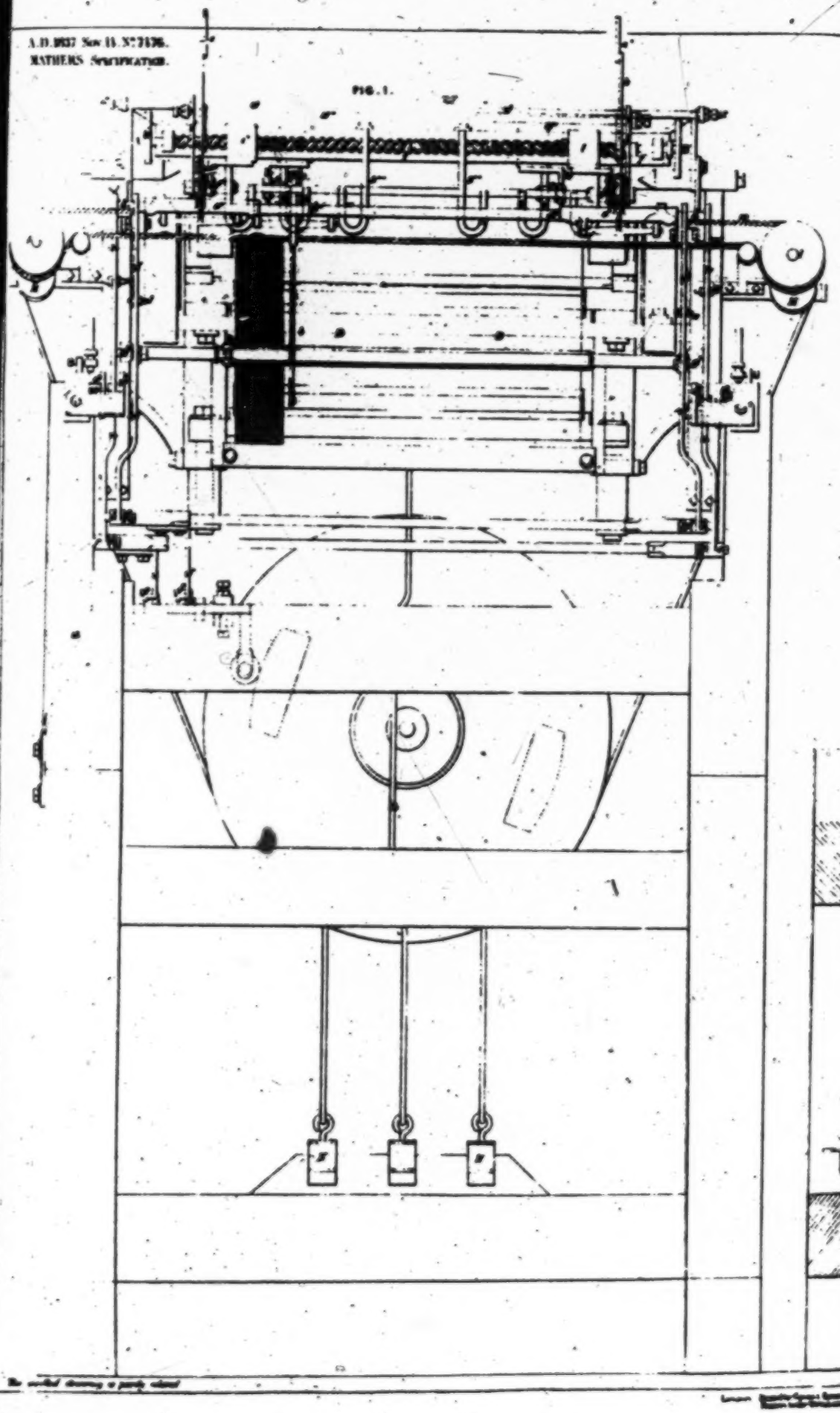
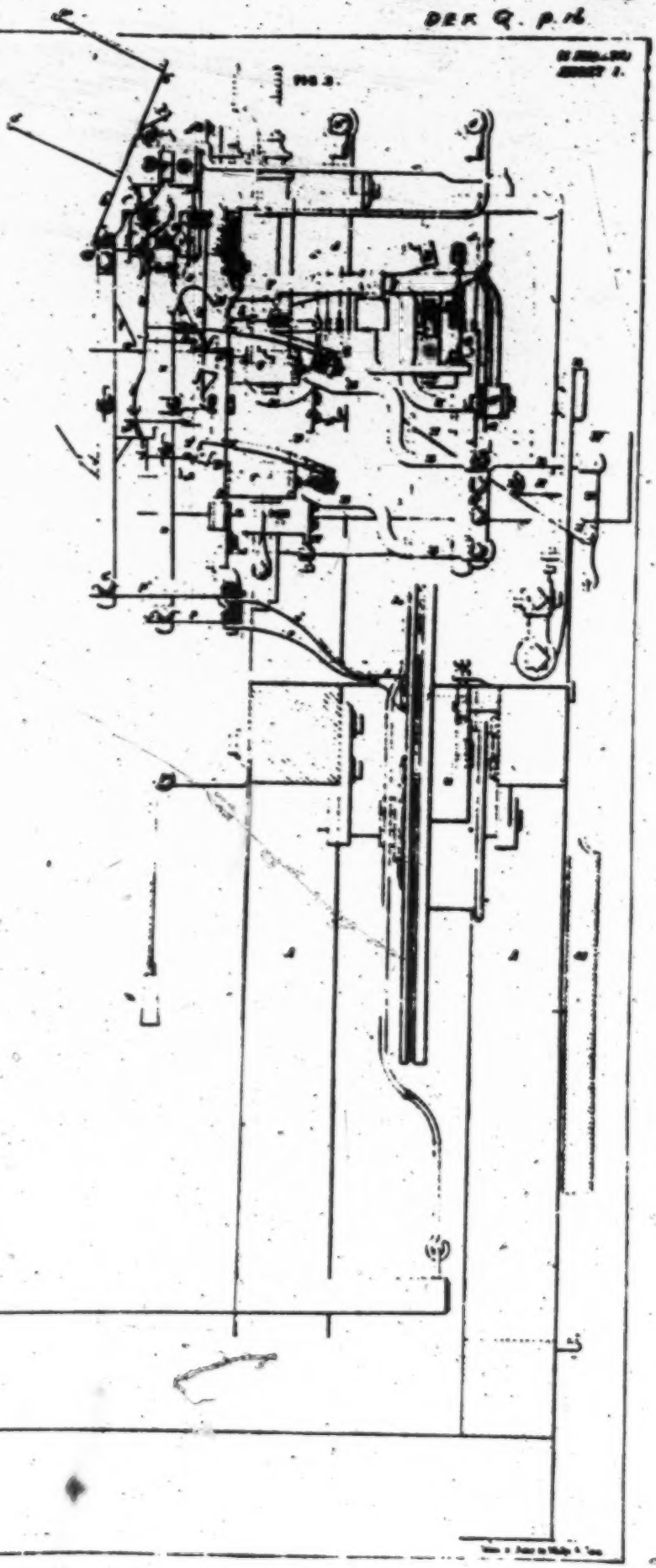


FIG. 14.

FIG. 2.

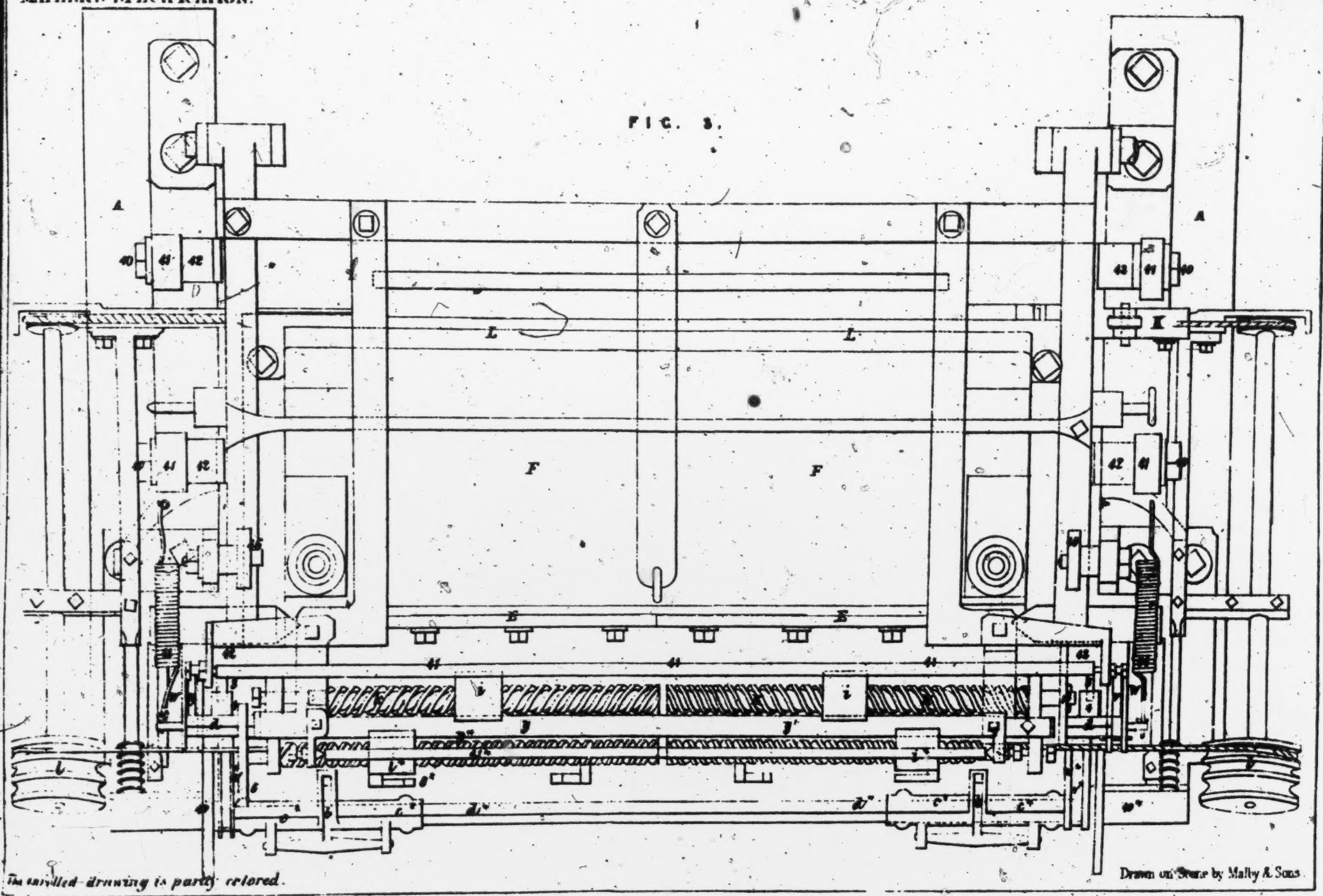


DEF. Q. P. 17

A.D. 1837. Nov. 14. N° 7476.
MATHER'S SPECIFICATION.

15 SHEETS
SHEET 2

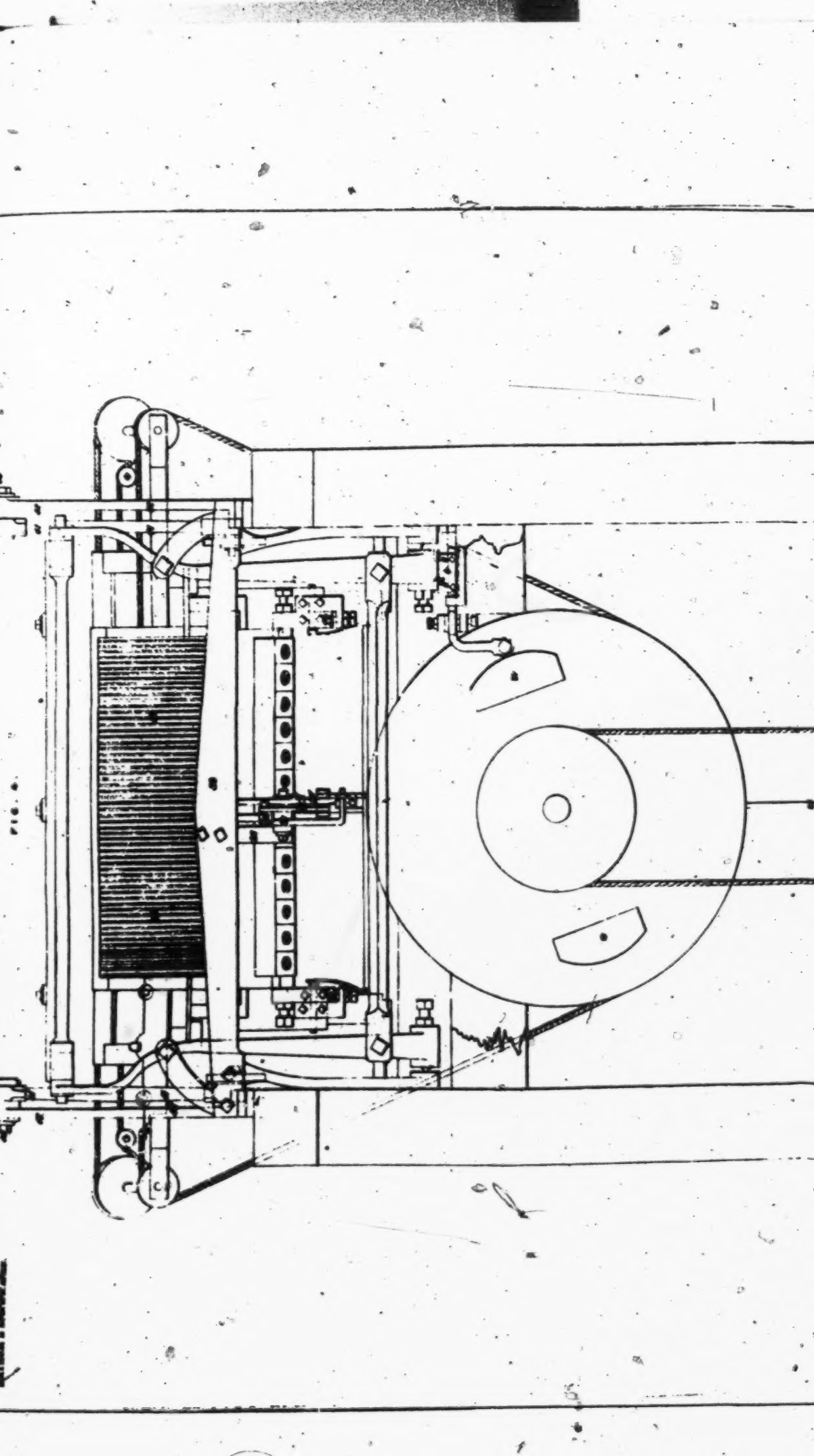
FIG. 3.

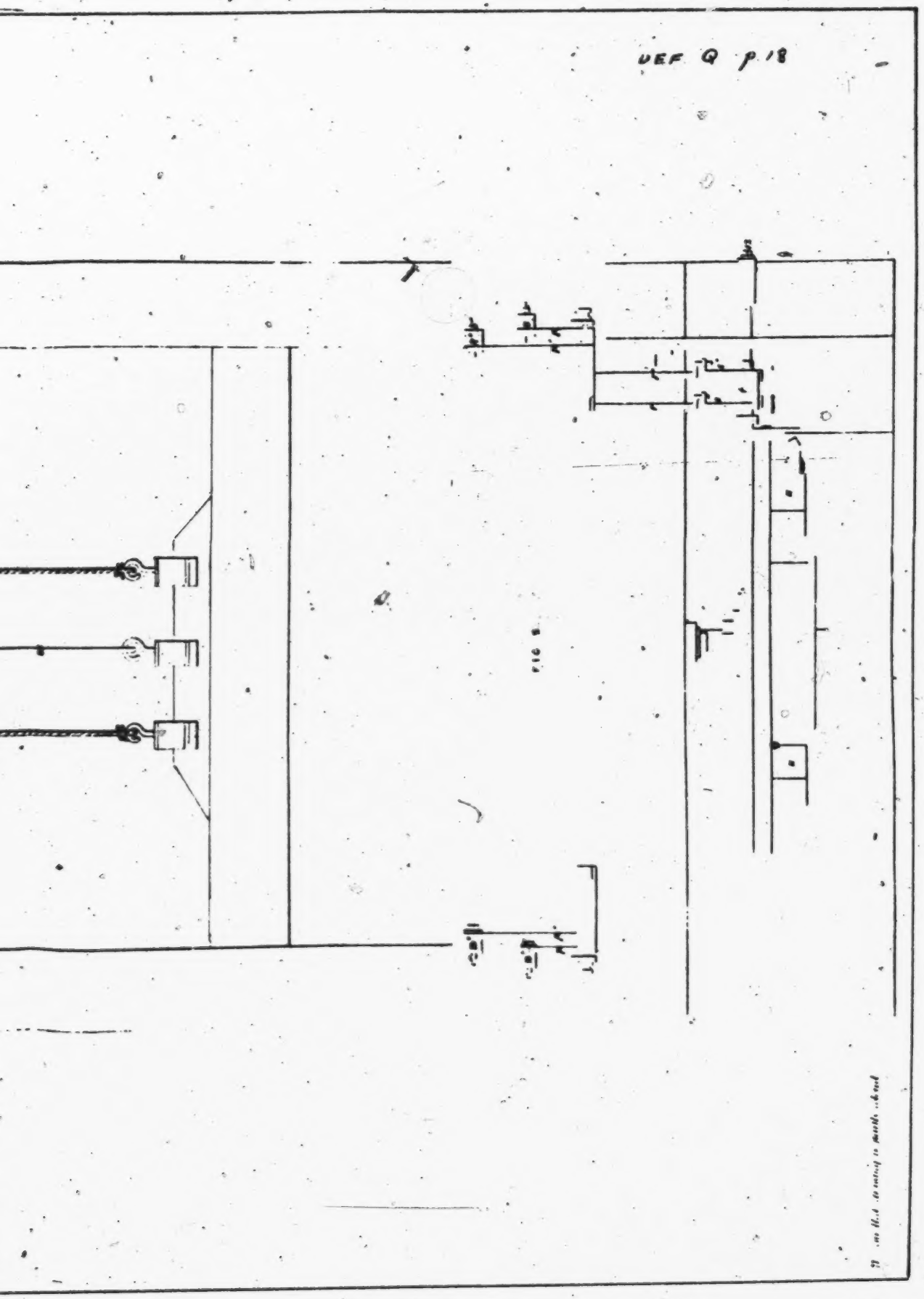


The engrossed drawing is partly retored.

Drawn on Stone by Maltby & Sons.

LONDON: Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1837.




REF Q p 18

A.D. 1837, Nov. 14. N° 7476.
MATHERS' Specification.

DEF. Q. p. 19

FIG. 8.

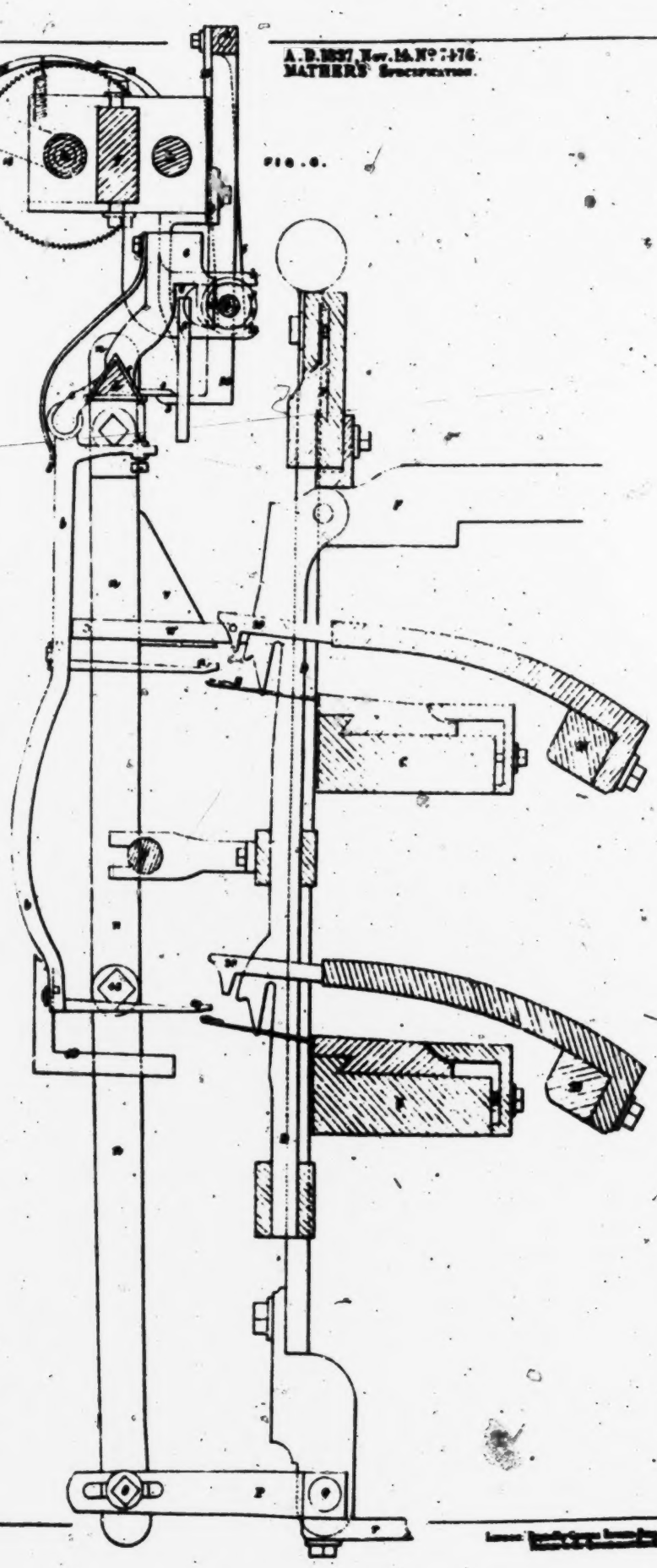


FIG. 9.

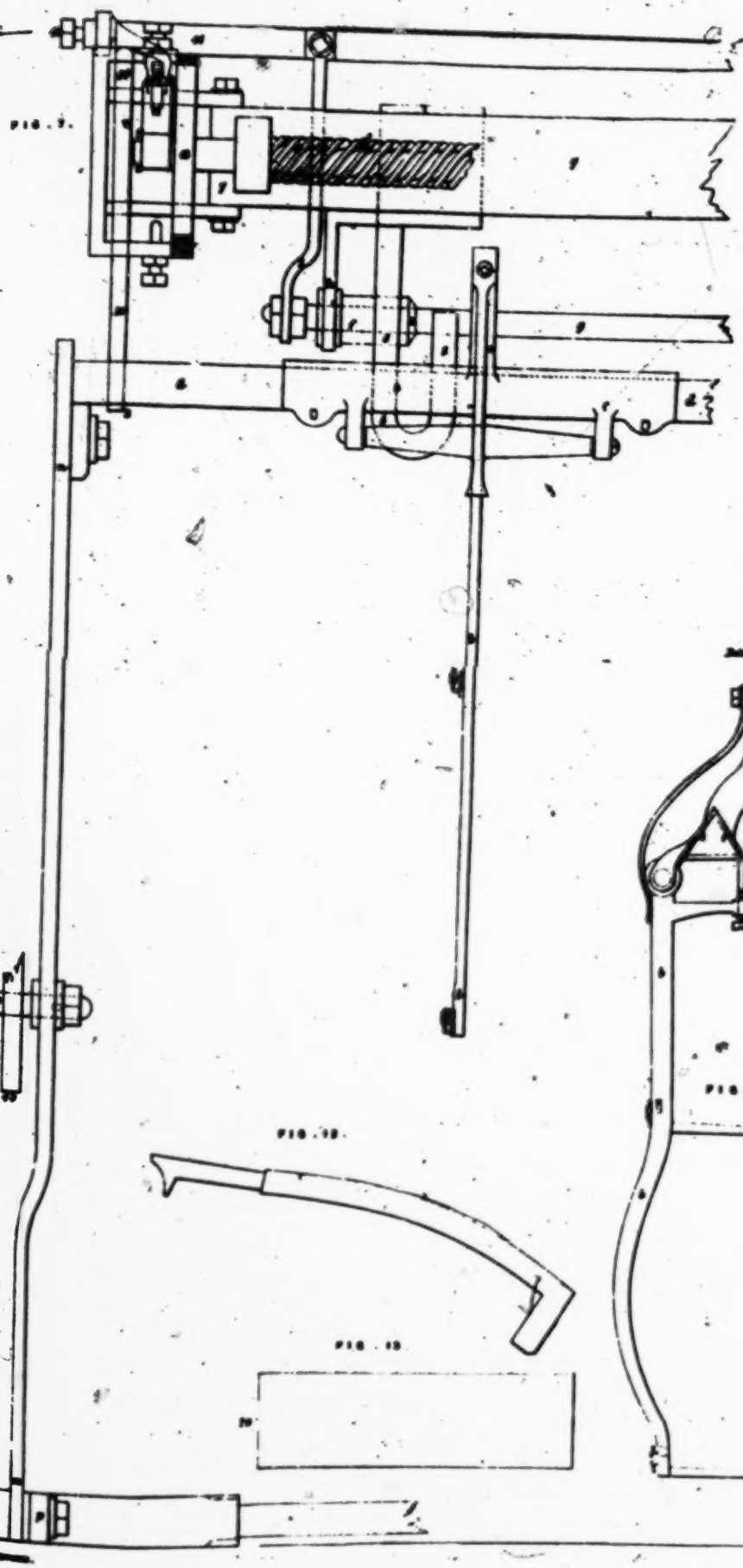
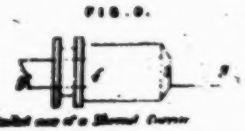


FIG. 10.

FIG. 9.



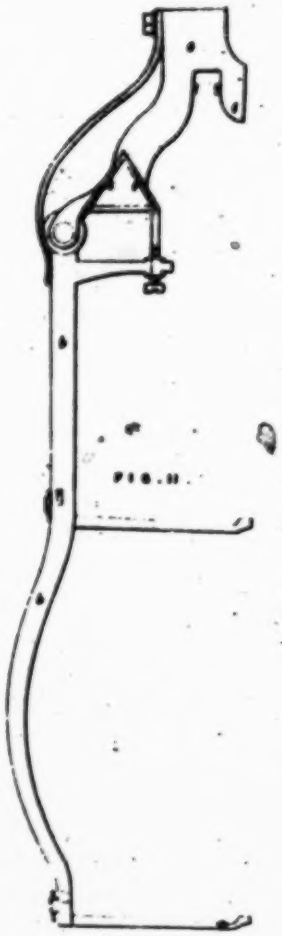
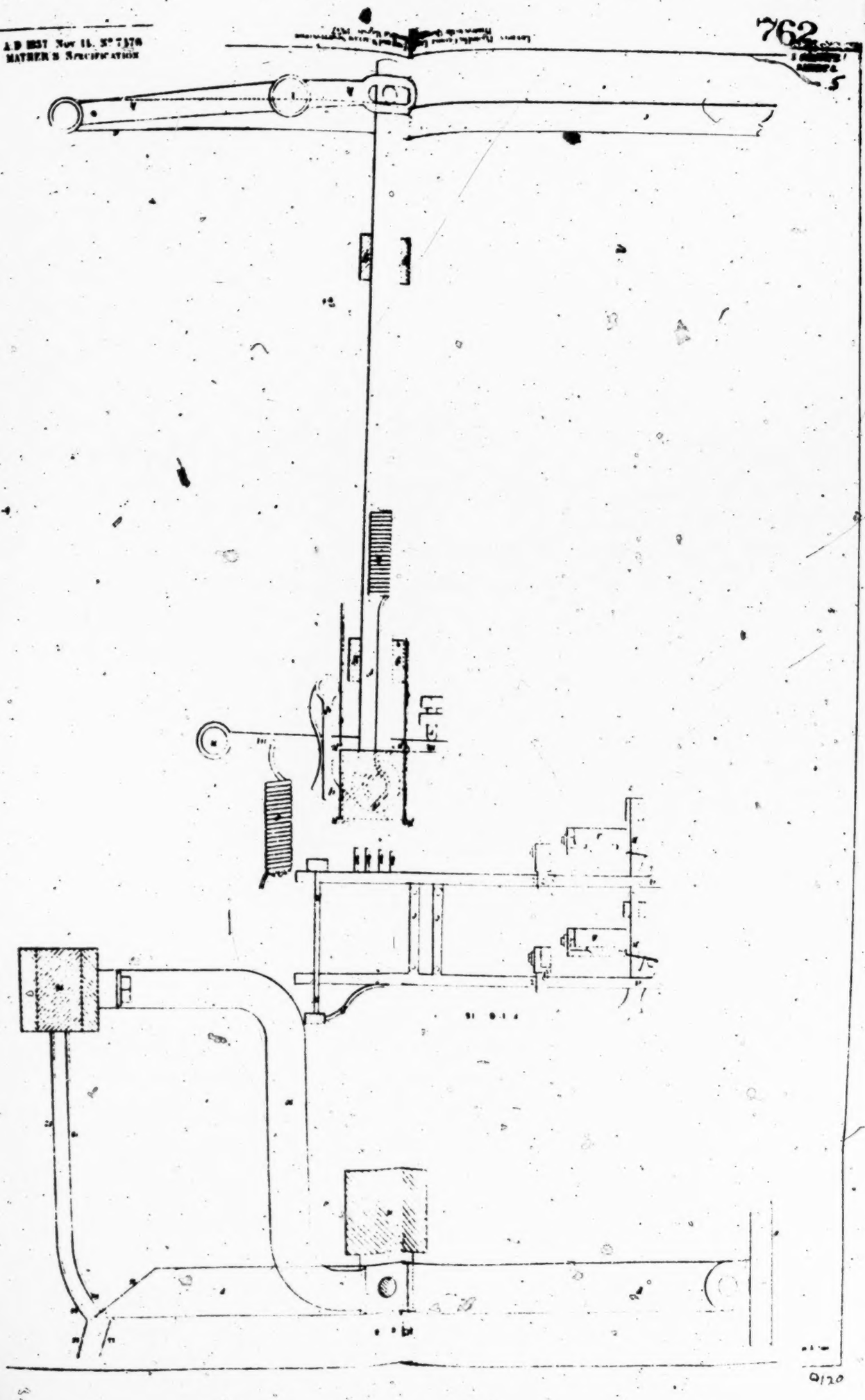


FIG. 11.

FIG. 12.

FIG. 13.

A.D. 1857 Nov 18. N° 2378
MATHER'S Specification



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DEFENDANT'S EXHIBIT R

Complete Cr. verification.

A.D. 1884.—N° 10,405.

De Pass' Improvements in Straight Knitting Machines.

Improvements in Straight Knitting Machines.

COMPLETE SPECIFICATION.

I, ERNEST DE PASS, of 68 Fleet Street in the City of London, Fellow of the Institute of Patent Agents, do hereby declare the nature of said invention for IMPROVEMENTS IN STRAIGHT KNITTING MACHINES, communicated to me from abroad by La Société Verdier, Moreau et Compagnie, of 5 rue du Conservatoire, Paris, France, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the accompanying drawings, and to the letters and figures marked thereon, that is to say :—

This Invention relates to certain improvements applicable to the manufacture of various kinds of knitted goods and more especially to that of stockings, which, by way of example, is taken in the following description.

The said improvements relate chiefly to the production of fancy knitted goods in several colours, and they also allow of the production of strengthened knitted articles; whether on a stripe on the axis of the web and upon the whole or a portion of this stripe, or upon the parts of the said web situated to the right and left of the said stripe, and upon the whole or a portion of the said parts.

Figs. 1, 2, 3, 4 and 5 (which represent stockings opened out) will give a general and sufficient idea of the results that may be obtained, although the number of possible combinations for each of the knitted articles in question is of course infinite, as will be readily understood on perusal of the present description. In these figures the parts hatched at different inclinations, or cross lined, differ from each other either in colour or in the strengthening.

Thus, in the stocking represented in Fig. 1, a stripe on the axis x, x, of any width, capable of being varied at will, occupies the whole length of the web; this stripe is of one colour whilst the parts on the right and left of the said stripe are of another colour, according as to whether these two last mentioned portions are to be, or not, of the same colour, thus fancy articles in two or three colours could be produced.

In the stocking represented in Fig. 2, the stripe on the axis x, x, only occupies a suitable portion of the length, and at its ends diminishes in the form of a series of steps of variable number; it is of one colour, whilst the remaining portion of the web which surrounds it is of another colour. (The steps referred to may be more or less pronounced and may if desired be merely in the form of almost straight oblique lines).

In the stocking represented in Fig. 3, the portion of the stripe on the axis x, x, (analogous to that of Fig. 2) is strengthened relatively to the remainder of the web surrounding it which gives a stocking strengthened at the knee. To obtain this strengthening it is sufficient to take—not as hereinabove described, yarns of different colours—but yarns of different thicknesses, the thickest being that which forms that part of the stripe situated on the axis x, x. It must of course be understood that the knees of drawers, tights, the elbows of under vests, etc., may also be strengthened in this way.

In the stocking represented in Fig. 4, the strengthening is effected on the parts situated to the right and left of the stripe on the axis x, x, in such manner that

the toe, the sole, and the keel of the stocking (this latter to as great a height as may be desirable) are strengthened, that is to say, formed by thicker yarn, whilst the remaining portion of the web, and especially the portion of the stripe on the axis corresponding to the instep or upper part of the foot, is not strengthened.

In the stocking represented in Fig. 5, strengthening by means of difference in the thickness of the yarns is effected in the same way as for the stocking represented in Fig. 4, except for the part of the sole corresponding to the hollow of the foot, that is to say, for a part of the sole less brought into action than the other parts.

These indications given, with the aid of some examples, the number of which might easily, but without any very great advantage, be multiplied, shew that fancy goods in several colours, and the strengthened goods previously referred to, may be thus produced by means of these improvements by the juxtaposition of yarns of different colours, or of sizes. By means also of these improvements such strengthened goods may also be produced by superposing the yarns.

The machine to which these improvements are supposed to be applied is a Dutch machine of the known type, consequently provided with a saddle furnished with two driving legs. On the frame of the machine are fixed supports of a special form, for the purpose of supporting on the front of the said machine, an inserted mechanism or additional mechanism distinct from that of the so called Dutch machine, this additional mechanism being also provided with its saddle having two driving legs.

In the description hereinafter given of the figures of the annexed drawings, the capital letters designate parts constituting the so called Dutch machine and the small letters the parts constituting the additional mechanism. In all these figures similar letters of reference indicate like parts.

Fig. 6, is a perspective view of the saddle A, of the Dutch machine, and of the saddle *a*, of the additional mechanism, this latter *a*, being provided with an arm a^1, by the aid of which and by three screws engaged at first in the holes a^2, then into the corresponding holes of the saddle A, the two saddles are firmly connected together, and thus united by a common connection are—taken as a hole—hereinafter termed the double saddle A, *a*.

Fig. 7 is a partial elevation of the Dutch machine and of its chief parts, amongst which are indicated the saddle A,—the left slur B, with jointed pawl—the left yarn holder carrier C—the heeler D—the right yarn holder carrier E—the right slur F, with jointed pawl—the bar G serving to raise the tube holders of the carriers C, E—the rack bar J—the grooved bar K—and the counter P, (wheel for pitch chain with its ratchet wheel and tooth of the counter).

Fig. 8 is a side view of these last mentioned parts.

Fig. 9 is an elevation of the additional mechanism which is superposed on the Dutch machine hereinabove referred to. For the purpose of greater clearness, in this figure the bar G of the Dutch machine has been omitted, its supports H, I, being shewn in section. Amongst the parts of the additional mechanism are indicated:—the saddle *a*, connected by means of the arm a^1, and the screws a^3, to the saddle A; the left slur *b*, with jointed pawls; the yarn holder carrier *c*; the right slur *f*, with jointed pawls; the supports *d*, *e*, fixed on the frame of the Dutch machine and supporting all the additional mechanism (excepting however the bar *g* which serves to raise the tube holder of the carrier *c*, the special supports *h*, *i*, of which are, for the purpose in view, fixed on the curved parts of the supports H, I, of the analogous bar G of the Dutch machine). It will be further observed that the supports *d*, *e*, *h*, *i*, are shewn in this figure and in figure 10 (to be hereinafter referred to) as capable of being adjusted horizontally to the right or left any desired extent; the same of course holds good with respect to the parts connected with these supports.

Fig. 10, is a part sectional plan corresponding to Fig. 9, the section being taken through the broken line 1, 2, 3, 4 of Fig. 9.

Fig. 11, is a partial end elevation corresponding to Fig. 9.

Fig. 12 is a general sectional elevation through line 5, 6 of Fig: 9. In this figure the following parts of the Dutch machine are indicated:—at O the needles; at P° the upper plates; at Q° the lower plates. At R R¹, the yarns passing to the carriers are shewn in dotted lines.

Fig. 13, is a part sectional elevation also taken through line 5, 6 of Fig. 9, and Fig. 14 is a sectional plan through line 7—8 of Fig. 13.

Figs. 13 and 14 have more particularly for object to represent in detail the yarn holder carrier *c*.

Figs. 15 and 16 are respectively a front view and a side view of the heeler D, made removeable, that is to say, so that it may, when desired, be placed on the bar J, or be removed from this bar, which is indispensable, as will hereinafter be seen for the working of the improved mechanism in question. This working is moreover assisted and regulated by the action of various flat and spiral springs.

For the production of fancy goods in different colours, the motion being supposed to have been communicated from the left to the right to the double saddle A, *a*, the slur *b*, first raises the driving leg on the right of the added saddle *a*, in such manner that this leg seizes the carrier *c*, at the desired point and carries along this carrier *c*, until the said leg encounters the slur *f*, which at the same time arrests the said carrier *c*, and causes the said leg of the saddle *a*, to escape. In the contrary case, the motion being supposed to have been communicated from the right to the left, the driving leg on the left of the saddle *a*, acts in the same way, but in reverse order relatively to the same slurs *f* and *b*. On these slurs are mounted sliding pieces b^1, b^2, for the slur *b*, and f^1 and f^2, for the slur *f*; these sliding pieces which are in the form of an angular bracket may be fixed by means of thumb screws b^{10}, b^{20}, f^{10}, f^{20} in different positions on the corresponding slurs *b*, *f*, and so as to bring into or out of action, as may be desired, the jointed pawls with which these slurs are provided, viz. b^3, b^4, for the slur *b*, and f^3, f^4, for the slur *f*. These pawls take into teeth formed in the two ends and on the top and bottom faces of the rack bar *j*, supported in the bottom ends of the supports *d*, *e*, relatively to which its position may be regulated, by means of screws j^1, j^2, the thumb screws d^1, e^1, serving to maintain it fixed in the desired position. The jointed pawls b^3, b^4, f^3, f^4, of the slurs *b*, *f*, have joint pins b^5, b^6, f^5, f^6, which project on the inner side and are operated by two grooved bars *k*, *l*, held at their ends by S-shaped pieces k^1, k^2, l^1, l^2; these S-shaped pieces are jointed to the ends of two balance or oscillating levers m^1, m^2, fixed on a horizontal shaft *m* which is supported in the bearings d^2, d^3, e^2, e^3, provided on the supports *d*, *e*; at its right hand end this shaft *m*, is fitted with a hand lever m^4, by means of which a movement of oscillation may be communicated to the balance levers m^1, m^2, which movement has for effect to move away from or draw nearer to each other, the grooved bars *k*, *l*. The lever m^4, which is here taken to be operated by hand, may be equally well operated by means of a counter with pitch chain, or by means of any other auxiliary mechanism of the same kind, an example of which is hereinafter given.

The pawls b^3, b^4, f^3, f^4 carry projecting parts terminating in horizontal pins b^7, b^8, f^7, f^8, which pins ascend (at the same time raising the corresponding pawls) along the slightly curved inclined planes in which the sliding pieces b^1, b^2, f^1, f^2, terminate, when the said sliding parts are caused to advance sufficiently to the right or to the left, this going on until the said pins become engaged in the semicircular recesses provided at the ends of the sliding pieces.

The pawls of which the pins are thus engaged, draw away sufficiently from the teeth of the rack *j*, that they may no longer engage therein. This being understood, let it be supposed that it be desired to widen the stripe on the axis, then the upper pawls b^3, f^3, are put out of action in the manner just indicated, and on the contrary, the lower pawls b^4, f^4, are left free to act, in order that, by reason of the motion communicated by means of the hand lever m^4, to the grooved bar *l*, the slurs *b*, *f*, shall draw away from one another. If, on the contrary, it be desired to narrow the stripe on the axis, the lower pawls b^4, f^4, are thrown out of action,

leaving the upper pawls b^3, f^3, in action, or free to act, and the movements of the grooved bar k, will cause the slurs b, f, to draw towards each other. Behind these slurs b, f, (see Figs. 10 and 13) are jointed the pieces b^9, f^9, the ends of which fall into the working space of the Dutch machine and may there serve as slurs for the driving legs of the saddle A; these pieces may if desired, be brought down in the direction of the arrows, and consequently no longer intervene in the working space of the Dutch machine. It may be observed that the carrier c, is fitted up so as to operate or not, as may be desired, at the same time as the carriers of the Dutch machine, or one or the other of these carriers. For this purpose (see Figs. 13 and 14) it suffices to keep a thumb-screw c^1, screwed up, or to unscrew the same which allows of the end of the carrier being pivoted, and of its being brought down in the direction of the arrow to the position shewn in dotted lines. During the time the stripe on the axis is not being made, the carrier c, the piece b^9, the carrier E, and the piece f^9, are put out of action for entering the stocking, for example, in order to make a passage for the carrier C, which operates by itself in the said entering; it is when this carrier C, thus works by itself that the heeler D, is placed in position to allow of escape being made. The bar n, fixed by its ends on the supports d, e, has only for object to guide and retain the head of the saddle a in its movement, not bearing too heavily on the saddle A and preventing injurious play.

The preceding indications suffice to explain how, by means of the double saddle A, a, and of the three carriers C, E, c, employed singly, or in combination, there may be produced by the juxtaposition of yarns of different colours, or of different thicknesses, fancy goods in several colours, or strengthened in the manner of those shewn in figs. 1, 2, 3, 4 and 5.

I will now indicate how these improvements in knitting machines allow of the production by superposition of the yarns of strengthened knitted articles like those represented in figs. 3, 4 and 5, by employing: 1. A first yarn which works into the whole width of the stocking: 2, a second yarn which produces the strengthening by becoming superposed on the first and which, for this purpose, only works on the part of the stripe on the axis, or on the parts situated to the right and left of said stripe which it is proposed to strengthen.

In order to obtain, by superposition of the yarns, the stocking strengthened at the knee, as shewn in Fig. 3, the pieces b^9, f^9, are let down, the heeler D, is placed in its usual position on the right where it will effect escape and thus all the operations hereinabove indicated for entering the stocking will be repeated except that the carrier c, will be left working at and during the desired time which will consequently work on the part of the web that has to be strengthened at the same time that the carrier C, will work over the whole of the width of the said web. To obtain likewise by superposition of the yarns stockings strengthened as shewn in Figs. 4 and 5, the carrier c is caused to work over the whole width of the web and for this purpose the slurs b, f, are put back suitable distances towards the left and right; the Dutch machine is then arranged as for making the heel, that is to say, with the heeler D placed in the middle of the rack J, of the said machine, and the slurs B, F, of the said machine are so arranged in position that the right and left yarn holders of the carriers C, E, fall into selvage exactly at the same points between the needles as the yarn holder of the carrier c; that is to say, in such manner that the carrier C falls at the same point as the carrier c, at the left extremity of the web, and that the carrier E, falls at the same point as the carrier c, at the right hand extremity of the web.

To effect diminishing the two following methods may be adopted:—1. The slurs b, f, having been brought to correspond exactly with the slurs B, F, these slurs are placed two by two in firm connection with each other so as to form two groups b, B, f, F, this connection being effected by means of rigid connecting pieces, the ends of which are screwed on to the said slurs; these connecting pieces are placed in the same direction and serve the same purpose with regard to the slurs (that of a common connection) as the arm a^1, with regard to the saddles A, a.

Then the spiral springs b^{10}, f^{10}, (one end of which is connected respectively to the slurs b, f, the other end keeping engaged the pawls b^4, f^4, which serve for widening the web) are unhooked in such manner that the said pawls are disengaged from the teeth of the corresponding rack j. In this way these slurs b, f, are upon each diminution, readily placed in suitable position by the action of the Dutch machine itself. 2. The second method of diminishing consists in removing the pieces b^9, f^9, and substituting other pieces also connected to the rear face of the slurs b, f, but are only capable of falling in a direction contrary to that of the pieces b^9, f^9; these new pieces project into the working space of the Dutch machine like those b^9, f^9, and terminate on the side of this machine in escaping surfaces of the same form as those of b, f, in such manner that they serve the same purpose with regard to the saddle A, as the slurs b, f, with regard to the saddle a. Then the end of the handle Q, of the tooth of the counter P, is connected by a connecting rod either to the end of the hand lever m^4, or to that of a lever fixed like this hand lever, on a suitable part of the shaft m.

Having thus described the invention and the means for practically carrying it out, as communicated to me by my foreign correspondent, such invention relating to the production of fancy knitted articles in various colours by the juxtaposition of yarns, as also knitted articles strengthened by the juxtaposition or superposition of yarns, I declare that what I claim is

The employment in combination with a Dutch, or other straight knitting machine, of an additional mechanism carried by the frame of the straight knitting machine and composing as its principal parts:—a saddle—a jointed thread carrier holder—two slurs with jointed upper and lower pawls, provided with means allowing the said pawls being, when desired, placed in or out of action, and with parts capable, when desired, of effecting escape into the working space of the straight knitting machine,—a rack bar provided with teeth on its upper and lower faces—two grooved bars connected together operating the jointed pawls of the slurs aforesaid, either direct by hand or by an intermediate counter, pitch chain or other accessory organs of this kind,—the saddle of the additional mechanism and the saddle of the straight knitting machine being in firm connection the one with the other, as also the lifting bars of the tube holders of the carrier of the additional mechanism: and of the two carriers of the straight knitting machine; the slurs of the additional mechanism being moreover capable, in certain cases, of being connected to the slurs of the straight knitting machine, as also may the special mechanism of the counter of the straight knitting machine be connected to the special mechanism for driving the grooved bars of the additional mechanism, all substantially as herein described and as illustrated in the accompanying drawings.

Dated this 21st day of April 1885.

ERNEST DE PASS,
Fel. Inst. P.A.,
68, Fleet Street, London.

LONDON: Printed by Eyre and Spottiswoode,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

1885.

FIG. 7.

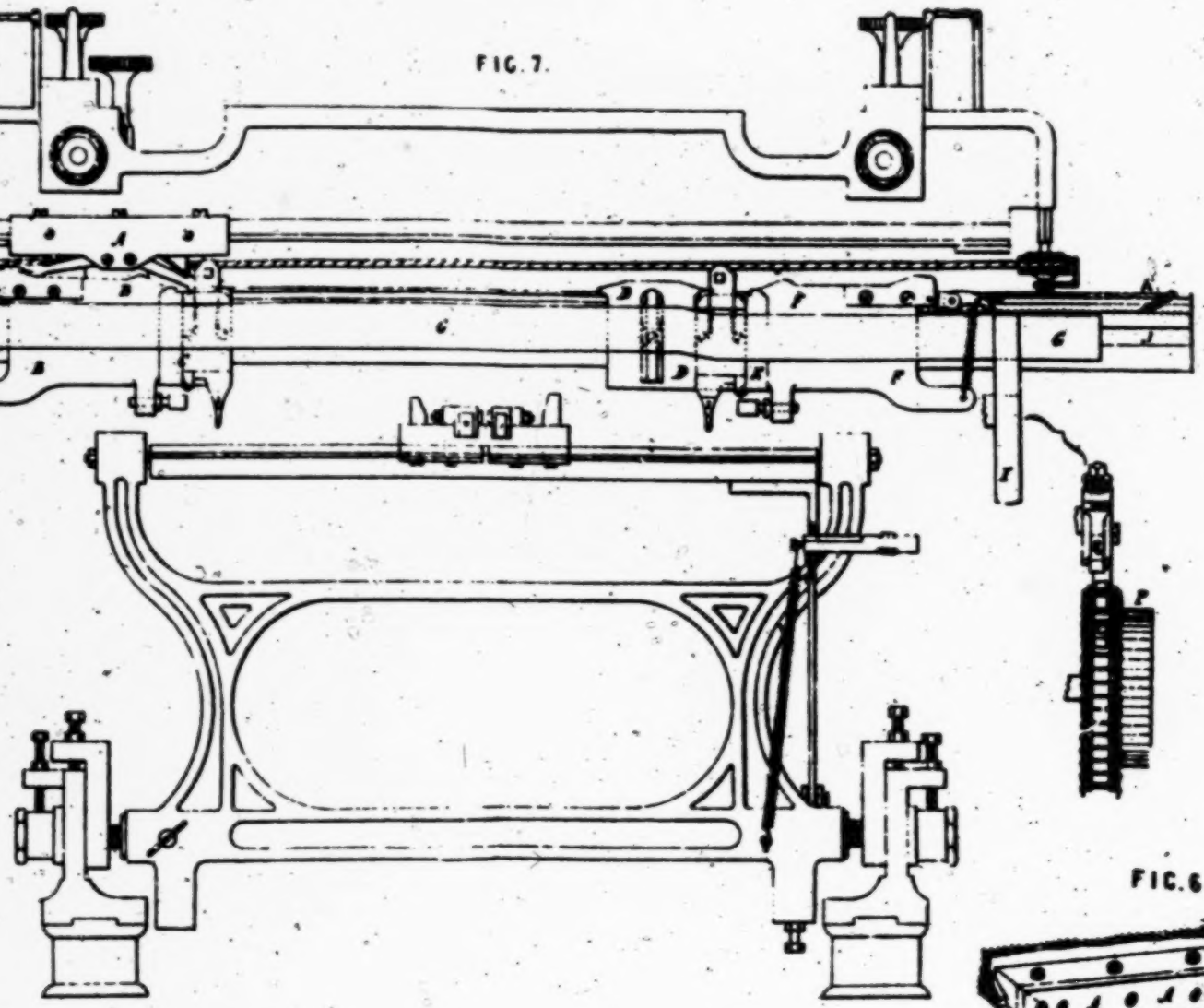


FIG. 8.

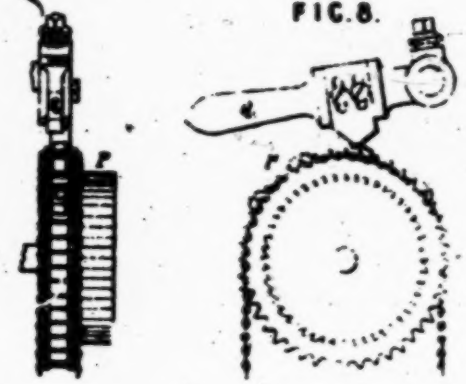


FIG. 1.

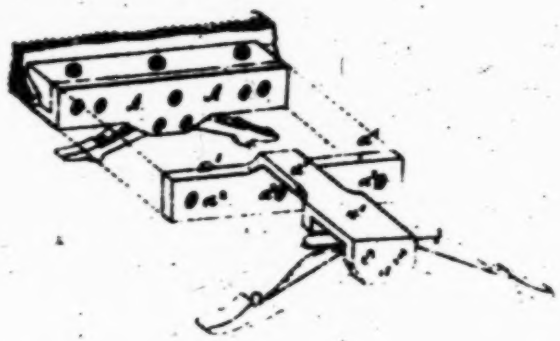
FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6



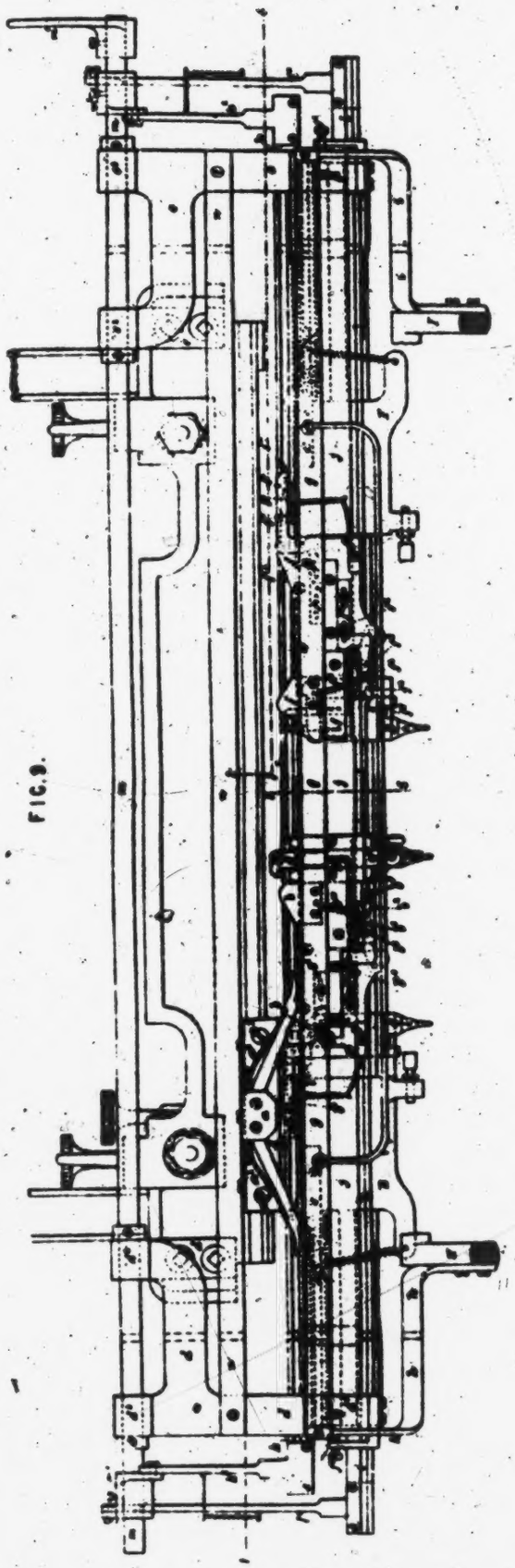


FIG. 9.

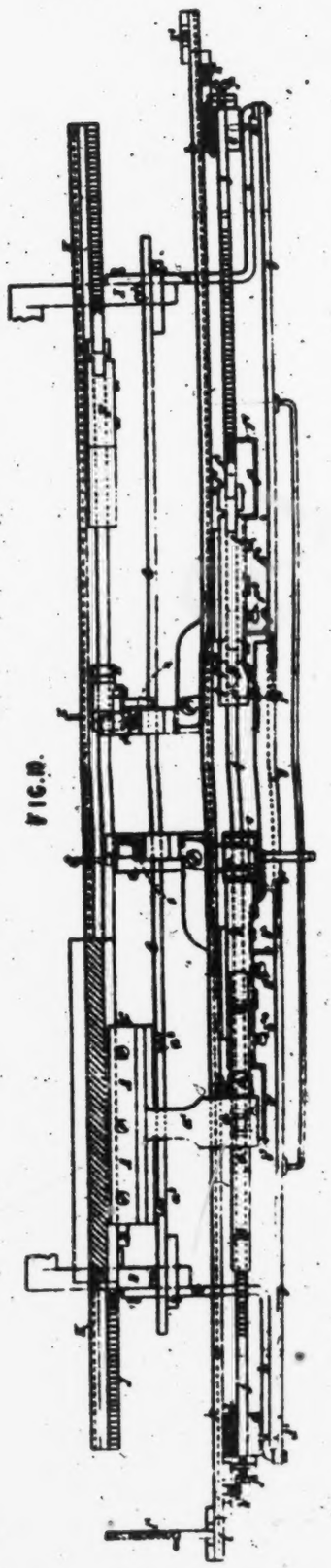


FIG. 10.

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630

740

FIG. 11.

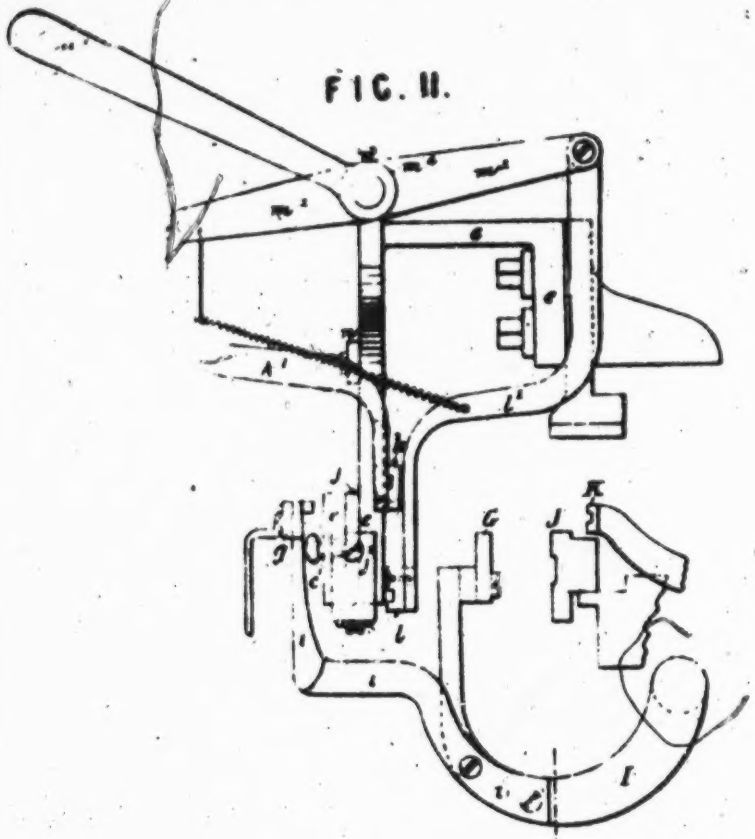

FIG. 12.

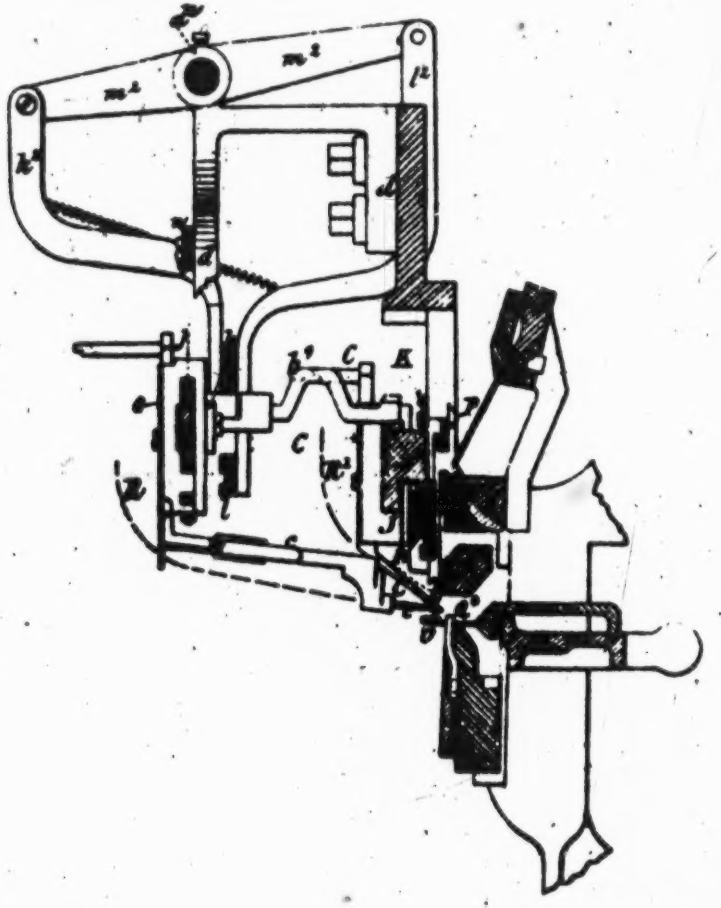

FIG. 13.

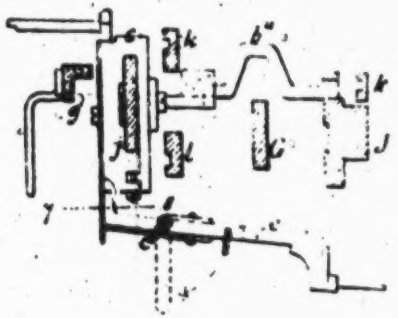

FIG. 14.

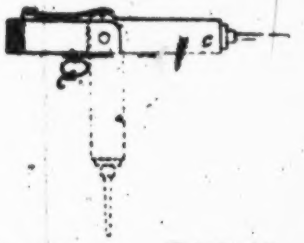

FIG. 15.

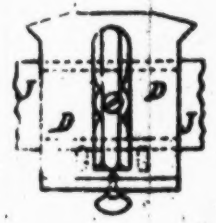

FIG. 16.

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narrowing machine at the front of the machine instead of using a snail cam or cams at one or both ends of the machine. This narrowing apparatus consists of worms and nuts carried by brackets. Each worm at one end is provided with a divided disc and a turn-over pawl; both pawls work on the same axis, which is moved by a handle lever or a cam or its equivalent on the machine. The throw of the pawl axis is capable of adjustment by a stop and set screw or their equivalent so that the action of the pawls may be increased or diminished as desired. The nuts on these screws project on one side and act as a stop to restrain the sliding movements of the carrier needle and narrowing apparatus. There is also in front of the machine a bar or rod which slides in bearings; it is moved to and fro by the driving cam and carries a friction key which operates upon the rod to which the carries are secured, moving it to and fro to a regulated distance. The narrowing machine consists of two bars and a number of points sliding on a platform under the carrier bar. The bars are moved and stopped by the projections of the nuts on the screws being held up to the stops by springs or their equivalent. The in and out and rising and falling movements of the points and their bars are operated by hand or by a rod lever and cam on the machine. The falling and rising movements of the carriers are obtained by a lever and cam at the centre or end of the machine. By this machinery or apparatus I produce a fashioned hose which is heeled and narrowed off on the same machine, instead of employing two or three machines for that purpose.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Edward Roe in the Great Seal Patent Office on the 23rd December 1869.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, EDWARD ROE, of the Town and County of the Town of Nottingham, Mechanic, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the First day of July, in the year of our Lord One thousand eight hundred and sixty-nine, in the thirty-third year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Edward Roe, Her special licence that I, the

said Edward Roe, my executors, administrators, and assigns, or such others as I, the said Edward Roe, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN THE MANUFACTURE OF LOOPED OR KNITTED FABRICS AND IN THE MACHINERY OR APPARATUS EMPLOYED THEREIN," upon the condition (amongst others) that I, the said Edward Roe, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Edward Roe, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My improvements are applicable to the rotary hose frame in which the well known jack sinkers, lead sinkers, and bearded needles are employed, and consist of the following apparatus:—Heretofore to obtain a narrowed looped fabric the carriers or thread layers have been placed above the sinkers and have been operated up n by levers moved by a snail cam or cams. I propose to place the carrier bar in front of the machine; this bar is supported by three brackets secured to the framing of the machine. The carriers are operated by means of a right-handed screw and a left-handed screw, each of which are provided with a notched disk secured to one end; between these disks is a hand lever and reversible pauls, which lever and pauls are operated by the hand, or they may be operated upon by a cam and levers in such manner as to cause widenings or narrowings to be made. The narrowing machine consists of two sliding bars which are held up to the stops by springs in the usual way; these stops are nuts through which the right and left handed screws are passed. The narrowing machine sliding bars slide to the right or left on a bar supported on trucks which slide to and from the needles on platforms carried by the three brackets before named. The to-and-fro movement may be communicated by hand or by a cam

and levers. The carrier needles at each selvage falls below the needles, being supported by the carrier bar which is free to turn in its bearings. The carrier bar is a round rod with a groove planed its whole length, in which groove the carrier needle bar slides. The partial revolution of the carrier bar is effected by a cam and lever at one end of the machine.

The manner of performing my said Invention is particularly described and ascertained in and by the following statement.

Description of the Drawings.

Fig. 1 is a front view of one of my improved rotary hose frames with my improved narrowing apparatus applied thereto; Fig. 2 is a sectional view of the same frame and apparatus shewing the relative position of the several parts when the frame is about to commence a course of work; Fig. 3 is a plan drawn the full size shewing portions of the right and left handed rocking screws, pauls, and disks, portions of the carrier slide bar and carrier bar, and part of the central bracket bearing; Fig. 4 shews in plan portions of the tickler bars with a right and left handed tickler bracket, each carrying ticklers and a point, which I shall refer to more particularly hereafter; Fig. 5 represents in section my improved narrowing and widening machine as applied to the improved hose frame; Fig. 6 is an end view shewing the cam and levers which lower and raise the thread carriers; Fig. 7 is a plan of the frame and narrowing apparatus, the standars of the framing being broken off above the slur cock bar to shew the chains attached to the slur cock sliding bar and the thread carrier sliding bar driver, such chains being operated in a manner more particularly described hereafter. The whole of the cams for effecting the movements of the several parts are shewn the full size on Sheet 5, and are numbered 1 to 7 both inclusive, and will be each referred to in turn, the whole of the corresponding parts being lettered alike where necessary. The following description will apply to each.

My improved frame consists of the following main parts:—Two end standards A and a central standard B connected together by two lower and two intermediate tie bars and one top tie bar, each lettered C; these standars and tie bars form bearings, or bearings are attached to them for the several parts of the machine, and amongst others the following, a web dle bar carrying the brackets of a presser bar I, a needle bar K, a

jack axle bar L, which is hinged to arms attached to a spindle bar L^1; the bar L has brackets attached to it which carry the locker bar M, and other brackets N also afford support for a slcy, through which the tails of the jacks are passed, and two bars carrying springs which press upon the tails of the jacks. O^1 is a shaft carrying the cams which give the required movement to the several parts. The cam shaft has a toothed wheel on its left end, which gears into another toothed wheel driven by a third toothed wheel on the handle shaft which carries a fly wheel and a fast and loose pulley for a belt from any prime mover. The parts known as the frame are a front spindle bar E lying in bearing arms attached to a back spindle bar F; to the front spindle bar are attached three vertical arms to which are secured a sinker bar G and a face bar or work bar H; the bar G has secured on it the frame sinker leads G^1. There is a bar at the back of the work bar, and in the space between these bars the lower ends of the lead sinkers G^1 and jack sinkers H^1 lie. The above-named parts being of the usual well-known construction will not require further description. The parts constituting the frame heretofore has been sunk by attaching a connecting rod or link to each end of the frame spindle bar E, thereby causing the said bar to spring or buckle in the centre when lowered by such links being operated upon by the sinking cam. Such plan I improve upon by obviating any tendency of the spindle bar to buckle or spring by attaching to the under side of each of the end bearing arms a knuckle joint D hinged to the top of a connecting rod having its lower end attached to a lever D^1 carrying a truck operated upon by the sinking cam, so that the pull acts direct under the bearings, which are themselves lowered instead of being pressed down by the spindle bar E.

A second improvement consists of the employment of snapping tackle constructed as follows:—To the front of the top tie bar are secured two projecting brackets P, the front ends of which carry an axle rod having on each projecting end a thread guide P^1. The axle has an arm secured on it hinged to a connecting rod P^2, which rod has its lower end attached to a lever operated by a cam No. 7 above the axle in the brackets P. Lying over the thread guides P^1 are two arms P^3 which are bent at right angles at their outer ends, where they are wrapped or covered with some soft material. These arms when pressed upwards turn in their bearings and will fall by their own weight or to stops placed to stay them in the position seen in Figure 2, the thread from the cop being passed through

the hole in the thread guide P^1, and thence through the holes in the carrier needle. The above-described snapping tackle will act in the following manner:—Each course the frame makes the thread which is slackened by the carrier needle being lowered and then raised by the cam No. 1 is tightened by the guide P^1 being pressed up to the covered part of the arm I^2, the thread being nipped between them, and while so nipped the guide P^1 and arm I^2 are slightly raised by the operation of the cam No. 7.

My third and main improvement consists of an apparatus for narrowing and widening the fabric. Heretofore to obtain a narrow looped fabric the carriers or thread layers have been placed above the sinkers, and have been operated upon by levers moved by a snail cam or cams, instead of which I attach three brackets R to the front of the machine. The upper ends of these brackets have bearings attached to them in which a carrier bar Q is free to turn; this bar is round with a groove planed in it its whole length; in this groove the carrier needle bar Q^1 slides. To this bar are secured the carrier needles Q^2. The carrier bar Q lies at the right end of the frame in a fourth bearing screwed to the front of the right end standard A; close to this bearing the bar Q has a lever Q^4 secured to it hinged to a connecting link having its lower end hinged to a bent lever Q^5 carrying a truck, which is operated upon by a cam No. 1, which causes the carrier needles to be raised into the position shewn at Figures 2 and 5. During its passage while laying the thread between the sinkers and the top of the needles, the carrier needles being then lowered under the needles previous to being raised for working another course, a spring Q^6 is attached to the lever Q^5 and to the end standard A to hold the truck to the cam. The traverse of the sliding bar Q^1 is effected in the following manner:—There is a collar placed so as to slide freely on the bar Q, which collar forms part of or may be attached to a short arm S^{13} which is screwed to the bar Q^1. Attached to the bearings on the central bracket R and right-hand bracket R is a flat bar S^5, on which a box S^6 slides; this box has a projection in front which carries on its under side a stud S^7, to each side of which a chain S^{14} is attached, which chain passes round a pulley S^8, two other pulleys U, and round a drum V, which makes an alternately reversed partial revolution. This drum with a similar drum W for driving the slur cocks is fully described in the Specification of a Patent granted to me for improvements and additions in or to the

machinery or apparatus for the manufacture of looped or knitted fabrics, and also of warp and weft fabrics, dated October Fourteenth, One thousand eight hundred and sixty-nine, and numbered 2999, such movements of the drum causing the box S^6 to slide alternately to the right or left. The upper side of the box carries a stud on which two drivers S^9 turn; each driver is held by a flat spring in the position shewn on plan at Fig. 7, so that as the box is moved to the right or left one of the drivers will catch the arm S^{13} and carry it along with it until such driver is thrown clear of the arm by the inclined end of the driver sliding over one or other of the trucks S^{10} or S^{11}, thereby allowing the driver to pass the arm S^{13} and the other driver to engage with the opposite side of the arm ready for the return motion. The truck S^{10} is supported by an axle secured to a stop S^{12} screwed on the top of a stop nut S^1 which traverses a screw at the right of the centre of the frame. The truck S^{11} is supported by an axle at one end of a rod, having its other end secured to a stop S^{12} screwed on the top of a stop nut S^1 which traverses a screw at the left of the centre of the frame. The stop nuts S^1 are advanced towards or moved from each other when they are required to move simultaneously in the following manner:— One of the screws S which passes through the stop nuts is a right-handed screw and the other a left-handed screw, each of which is provided with a notched disk S^3. At one end between these disks is a hand lever and two reversible pauls S^4, each of which take into the notches of one of the disks, so that suppose the pauls point upwards and the handle is raised up so as to rack the disk, the stop nuts S^1 will be moved away from the centre for the purpose of widening the fabric, and if the pauls be reversed and the handle depressed to rack the disks the stop nuts will be moved towards each other for the purpose of narrowing the fabric. Each of the stop nuts have a projection on their lower side to which a clip is screwed which embraces bar S^5, which prevents the stop nuts from being carried round with the screws when they are racked. The bars S^5 are secured at each end to the screw bearings which are attached to the brackets R. The traverse of the carrier needle sliding bar is stopped at each end by a short arm Q^1, shewn by dotted lines in Fig. 2, and another arm Q^2, shewn in a lowered position at Fig. 5, each of which strike against one or other of the stops S^{12}, so that the position of these stops determine the length of traverse of the carrier needles to form the selvages either in widening or narrowing, and by the same means the tickler bars are operated, being arranged as

follows:—A bar T is grooved out to allow of two bars T^1 and T^2 to slide therein, being held down on the bar T by caps, one of which is seen in plan at Fig. 4. The bar T is supported on trucks T^3 which run upon platforms T^4 carried by the three brackets R before mentioned. To each sliding bar are secured the requisite number of brackets, which carry a number of ticklers T^5 and also one point T^6 to each brackets. The bars, brackets, ticklers, and points are moved to or from the needles by the operator, or such to-and-fro movement may be communicated by a cam and levers. The relative distance the brackets stand from each other is determined by the position of the stop nuts S^1, to each of which is attached a stop bar and spring T^7 which lie upon each side of a stud in each of the tickler bars T^1 and T^2. Such stop and spring is shewn in side view at Fig. 5, and in plan at Fig. 7.

The cams which effect the combined movements of the several parts are shewn in Sheet 5; No. 1 being the cam which operates the thread carrier needles; No. 2 is the same as No. 9, and are the frame sinking cams; Nos. 3 and 8 are alike and operate the presser bar; No. 4 and 5 move the hanging frame to and fro; No. 6 is the locking cam and operates the locking bar; and No. 7 operates the snapping tackle.

Having described the several parts of my improved narrowing and widening apparatus, I will describe separately, first, the operation of narrowing the fabric, then that of widening the fabric.

The narrowing is performed in the following manner:—The movements of the frame having brought the loops forward to the eyes of the needles the ticklers are pushed towards and placed upon the beards of the needles and slightly depressed, the loops are brought by the frame into the ticklers and clear of the needle heads, the right and left threaded screws being then racked by the pauls of the hand lever carries the said loops and places them on the next adjoining needles or otherwise, the frame takes the loops past the beards on to the stem of the needles, so that the next motion of the frame will secure the loops, and the fabric will then continue to be made in the usual manner until the above-described movements are required to be made for the next narrowing.

For widening the fabric, in addition to four or other number of ticklers used in each bracket when narrowing the fabric, I also use a plain point T^8, see Fig. 4, which lies by the side of the ticklers on the inside and is moved to or from the needles, and is racked to the right or left

at the same time as the ticklers by the operator at each widening in the following manner :—The ticklers and points being placed on the needles, as before described, the loops are brought forward into them by the frame, the ticklers and points are slightly raised so as to keep the loops on them above the needles until they are racked outwards, they are then placed on the needles, the frame moves forward and takes the loops back past the beards of the needles, and upon the frame again advancing a loop is placed upon the whole of the needles, thereby filling up the hole which would otherwise be produced if performed by the method heretofore used.

Having now described the nature of the said Invention, and in what manner the same is to be performed, I declare that what I claim is, the arrangement and combination of parts of machinery to produce narrowed or widened looped or knitted fabrics, as herein-before described.

In witness whereof, I, the said Edward Roe, have hereunto set my hand and seal, this Twentieth day of December, in the year of our Lord One thousand eight hundred and sixty-nine.

EDWARD ROE. (L.S.)

Signed, sealed, and delivered by
the within-named Edward Roe,
in the presence of

SAMUEL PARSONS,
Solicitor,
Nottingham.

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1869.

DEF. S. page 9

A. D. 1869. June 1. N° 1991.
ROE'S SPECIFICATION.

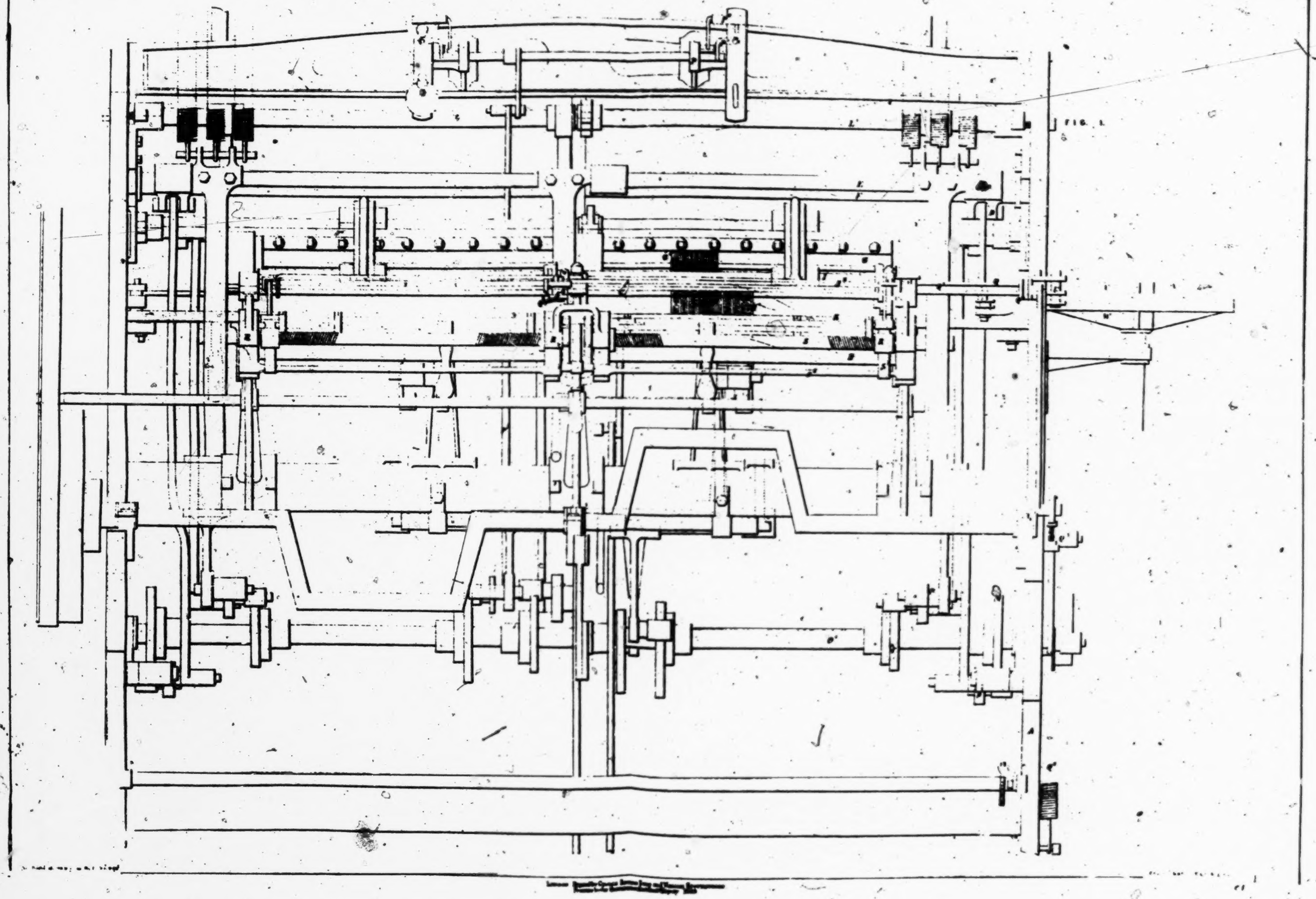


FIG. 1

780

DEF. S. page 10

A.D.1868. JULY 1, 3rd 1891.
ROE'S SPECIFICATION

3 SHEETS
SHEET 2

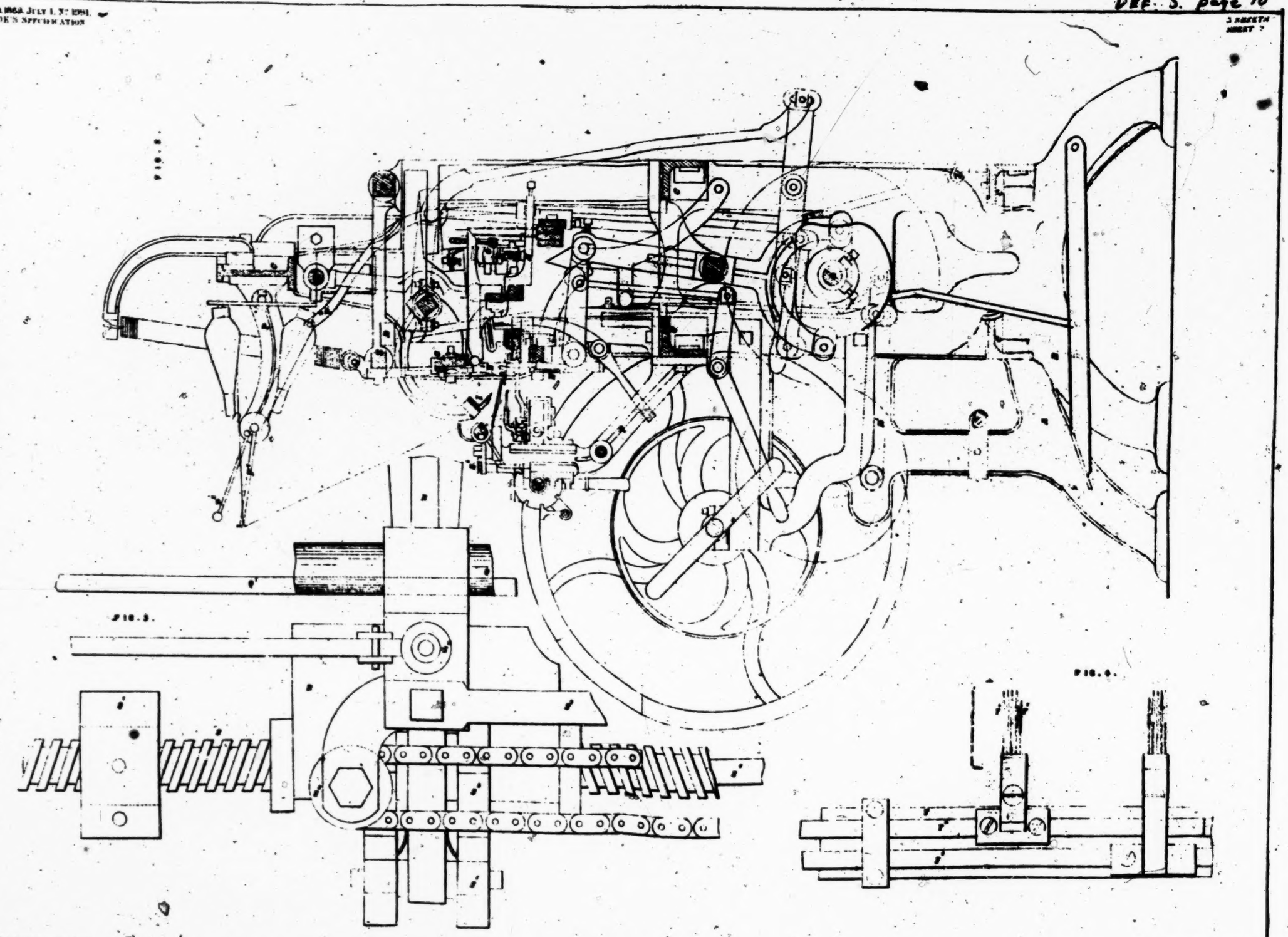


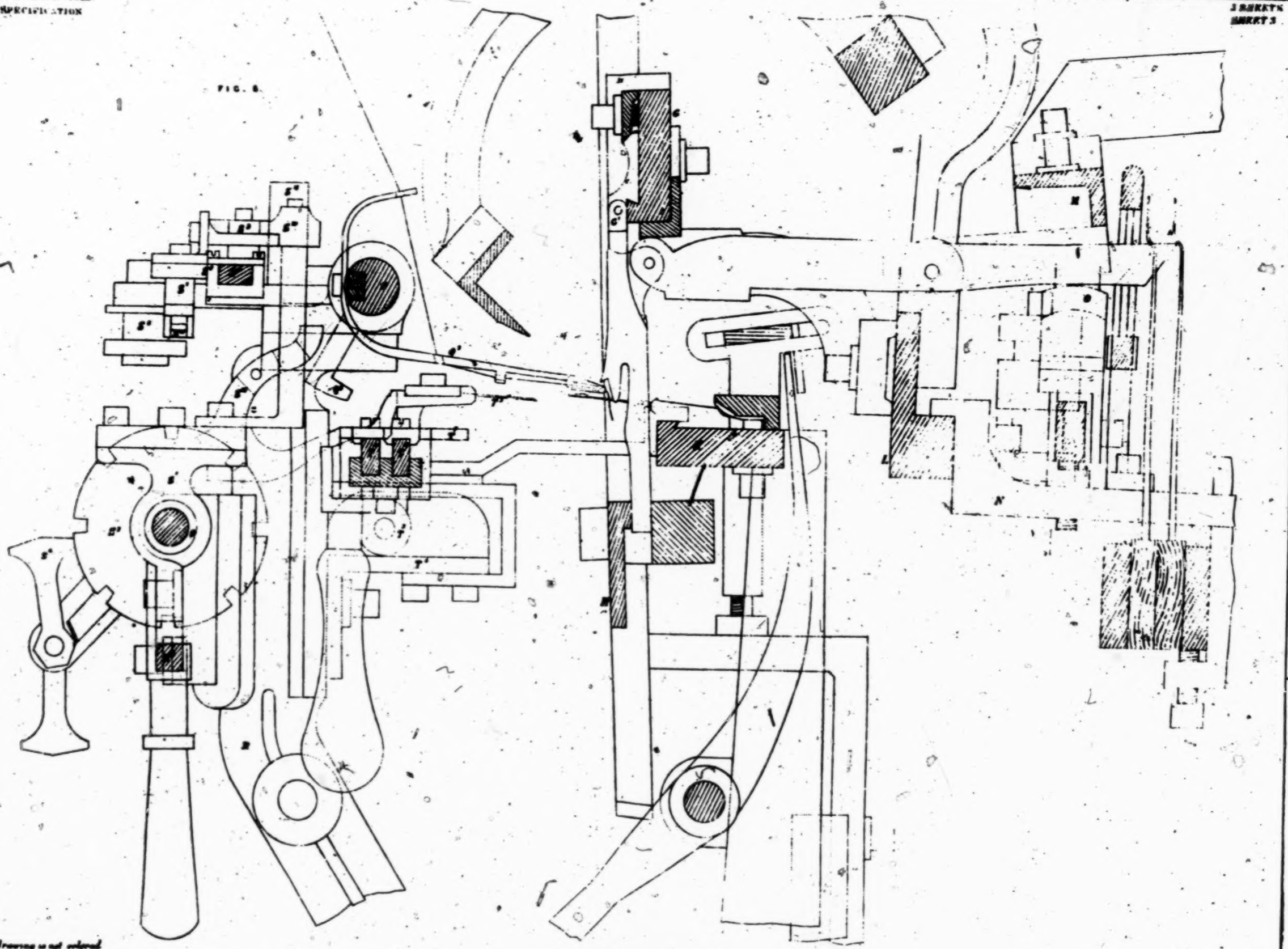
FIG. 3.

FIG. 4.

A.D. 1868 JULY 1. N° 1991.
ROPES SPECIFICATION

3 SHEETS
SHEET 3

FIG. 8.



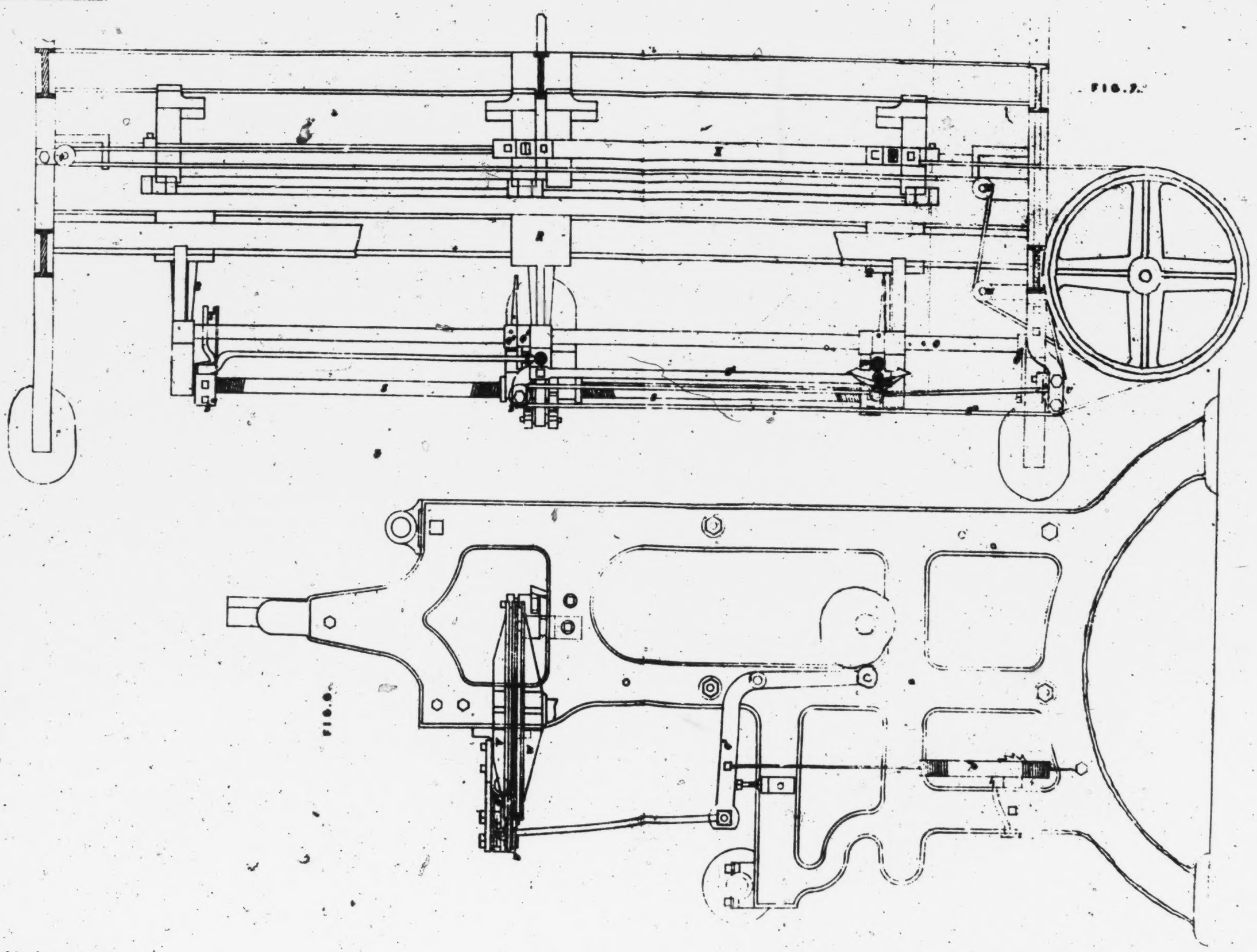
The third drawing is not referred

782
DEF. S. page 12

A.D. 1868. July 1. N° 1901.
ROE'S SPECIFICATION.

(5 SHEETS)
SHEET 1

FIG. 1.

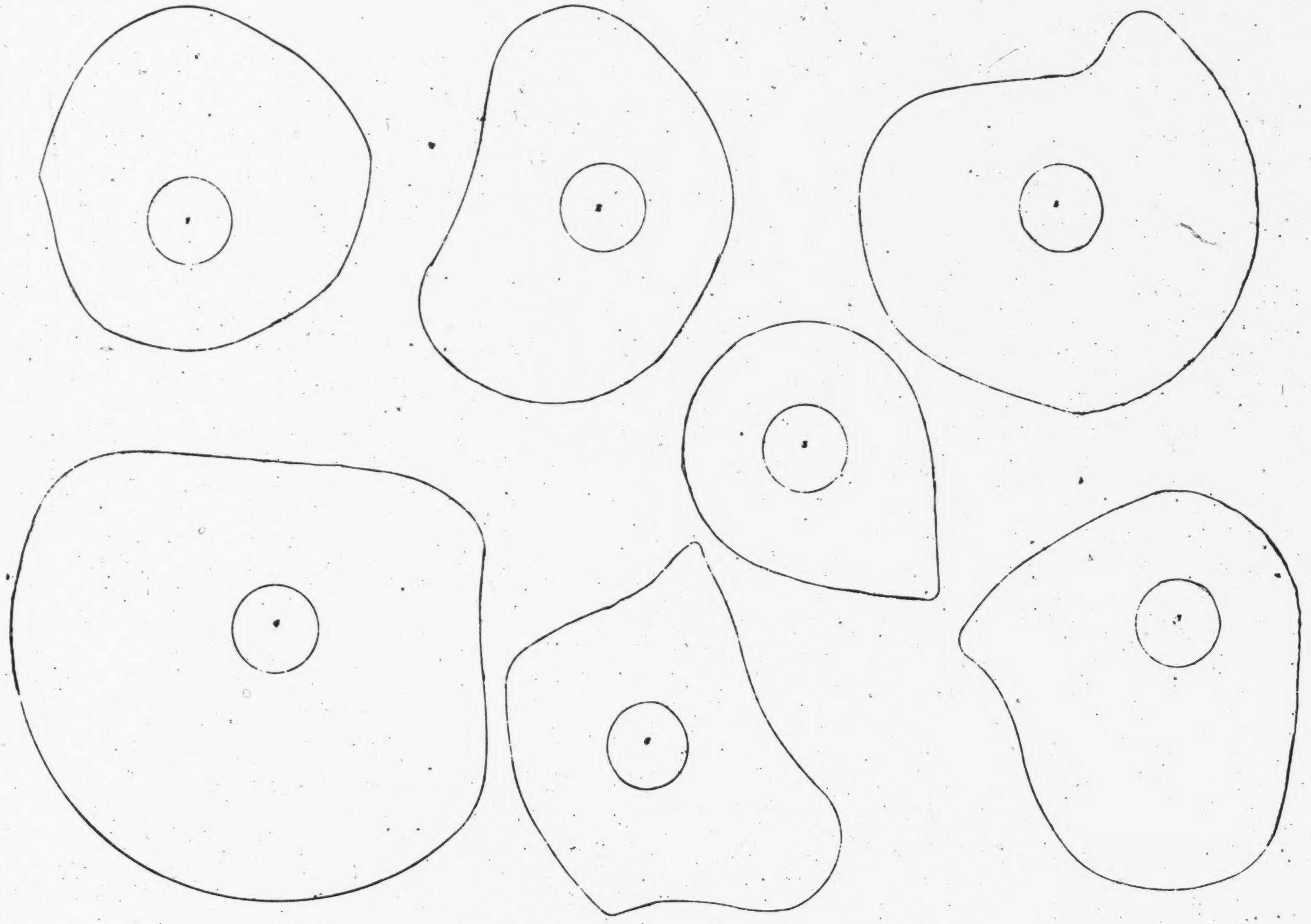


The filed drawing is not reduced

DEF. S. page 13

A D 1869 JULY 1 AY 1991.
RDE 5 SPECIFICATIONS.

(3 SHEETS)
SHEET 3.



The filled drawing is not colored.

DEFENDANT'S EXHIBIT T — 784

Specification. A.D. 1871.—N° 573. 3

Willatt, Gee, & Goss' Impts. in Manufacturing Looped or Knitted Fabrics.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Henry Willatt, Robert Gee, and John Goss in the Great Seal Patent Office on the 2nd September 1871.

TO ALL TO WHOM THESE PRESENTS SHALL COME, we, HENRY WILLATT, of New Basford, in the County of Nottingham, Manager, ROBERT GEE, also of New Basford, aforesaid, Working Smith, and JOHN GOSS, of the same Place, Framework Knitter, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Third day of March, in the year of our Lord One thousand eight hundred and seventy-one, in the thirty-fourth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto us, the said Henry Willatt, Robert Gee, and John Goss, Her special licence that we, the said Henry Willatt, Robert Gee, and John Goss, our executors, administrators, and assigns, or such others as we, the said Henry Willatt, Robert Gee, and John Goss, our executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN MACHINERY OR APPARATUS EMPLOYED IN THE MANUFACTURE OF LOOPED OR KNITTED FABRICS," upon the condition (amongst others) that we, the said Henry Willatt, Robert Gee, and John Goss, our executors or administrators, by an instrument in writing under our or their hands and seals, or under the hand and seal of one of us or them, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that we, the said Henry Willatt and Robert Gee, on behalf of ourselves and of the aforesaid John Goss, do hereby declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, reference being had to the accompanying

Drawings, and to the letters and figures marked thereon, that is to say:—

In producing a looped or knitted fabric we employ a series of needles known as the latch needle. Each of these needles we solder or otherwise secure in a needle bit, which needle bit has a projection on one of its sides. These needle bits are held by and slide to and fro in a brass or other sley cut to the gauge required. This sley may be placed in a vertical or horisontal position, and it is secured to a fixed bar or bars held at each end and also intermediately, if required, by standards connected together by tie bars or tie rods. The projecting part of the needle bits lies in a groove formed by the edges of two V or otherwise shaped sliding cam plates which are secured to or form part of a sliding piece which has parallel V grooves at its edges, which edges slide upon two longitudinal fixed V-edged bars secured to the brass or other sleys, or to the bar or bars which support the sleys. A thread carrier is attached to the top of the sliding piece or other part of the machine or apparatus which also supports the requisite apparatus for tightening the thread. The sliding piece is moved to the right and left alternately by a cam lever and connecting rod, or by any other means usually employed. In addition to the sley for the needle bits there is a second brass or other sley in front of the first sley. In this sley the needles slide, being projected from the front of the sley to receive the thread from the carrier, the needles being then drawn back within the front sley sufficiently to ensure the work being knocked over the heads of the needles. The outer edge of the front sley is recessed on its under side, and the recess thus formed receives the top edge of a face bar or work bar. Between the top edge of this bar and the sley the work will pass as it is produced.

We propose to arrange the apparatus as above described for producing plain looped or knitted fabrics, and for producing fancy fabrics we employ similar apparatus with the addition of the required thread carriers to supply threads of divers colors. At each selvage of each breadth of fabric we propose to use wheels having points projecting from their circumference to hold the selvages well out, and when we desire to make a ribbed, looped, or knitted fabric we employ a similar apparatus consisting of one or more sleys placed in a vertical position, which sley or sleys slide needle bits and needles, the vertical needles

sliding between the horisontal needles, and being moved by V or otherwise shaped cam plates which have the requisite lead given them by any of the means usually employed, the cam plate being moved to the right or left in any convenient manner.

Having thus set forth the nature of our Invention we proceed more particularly to describe the manner of performing the same with reference to the accompanying Drawings.

Description of the Drawings.

Figure 1 is a sectional view of a machine constructed according to one of our improvements; Figure 2 is a front view of the same machine, and Figure 3 an enlarged sectional view of the main working parts; Figures 4 and 5 represent respectively a plan and edge view of the sliding bar to raise the needles; Figure 6 is a front view of one of the rack plates, and its sliding cover plate employed for narrowing on the left edge of the fabric; Figure 7 is a plan of the same; Figure 8 is a sectional view of one of the moveable parts of the work bar showing the catch which secures the same when required; Figure 9 is a front view of the same showing the moveable left end of the work bar and a portion of the fixed middle part of the bar; Figure 10 shows in plan a double-slotted bar and two sliding cam plates; Figures 11 and 12 show an end view and front view of the apparatus which throws the narrowing cam shaft in and out of gear; Figures 13 and 14 are respectively front view and plan of a thread layer and inclines which depress certain holding back spring bits.

A, A, are end standards connnected together by tie bars B. The upper one is planed true on its top side, and has a needle sley C secured to it (see Figure 3), in which needle bits D slide to and fro, the sley being cut to the gauge required. In each needle bit is soldered or otherwise secured a needle known as the latch needle. The bit has a projection on its top edge which slides in the grooves on the under side of the cam plate C^1, which slides in clips C^4. At each end of the sley C the cam plate has a to-and-fro movement communicated to it by a link C^3 hinged to it at the back of the machine, and also connected with the upper end of a rocking lever C^5 which works on an

axle at its lower end carried by the bottom back tie bar B, the lever C^4 carries a truck which takes into the groove of a driving cam C^7, Figures 1 and 2.

The cam plate is constructed as follows:—The under side of the cam has a straight groove the whole of its length, but it is cut away at the centre to form a space for the two cam plates C^2, C^3, to slide in, each of which cam plates is turned back over the front edge and top of the bar C^1. There is a stud on the top near the back ends of the plates C^2, C^3. These studs take into slots in a bar C^5, which bar is moved to the right and left alternately by its striking against adjustable studs in brackets screwed to the top tie bar B, such movements being in addition to the sliding movements of the bar C^1, upon which it slides. The right and left movements of the bar C^5, cause the plates C^2, C^3, to alternately advance and recede, the advanced plate preventing the needles from receding in advance of the thread layer. A thread carrier E is attached to the top of a sliding bar E^1. The extent to which this bar slides is governed by means herein-after described. The bar E slides in bearings carried by a rocking bar E^2 which rocks in bearings attached to the bar g^1, the rocking motion of which is communicated by a T-ended lever E^3 attached to a second rocking shaft E^4 at the back of the machine; the shaft E^4 is operated by a link hinged to it and to a lever working on a cam E^5. In addition to the sley for the needle bits there is a second sley F in front of the first sley. In this sley the needles slide, being projected from the front of the sley to receive the thread from the carrier and thread layer, the needles being then drawn back within the front sley sufficiently to ensure the work being knocked over the heads of the needles. The outer edge of the front sley is recessed on its under side. The recess thus formed receives the top edge of a work bar G. Between the top edge of this bar and the sley the work will pass as it is produced. Above the needle sley a third sley H is secured, in the back edge of which holding back springs are soldered or otherwise secured. These springs when depressed will hold the work from coming forward during the advance of the needles. The springs are depressed between the needles by inclined bits H^1 (see Figures 3, 13, and 14, which are secured to a bracket attached to and moving with the grooved bar C^1. The sleys F, G, H, are divided into three parts, the outer parts of the bar G are held by brackets which turn upon

an axle G¹, held fast in bearings supported by arms secured to the top tie bar B. The brackets carrying the central portion of the bar G are held by brackets secured fast on the axle G¹. The outer parts of the bar G when a narrowing is being made are brought forward, a lever at each end of the breadth of fabric shown at Figure 9 and by dotted lines at Figure 8, the slots of which levers secures a pin in each outer bracket. Above the front end of the needles is a plate carried by a stud I on the under side of the bracket which carries the inclined bits H¹ (see Figures 13 and 14). This plate is slotted in front. In this slot the lower end of the thread carrier lies, the thread from which passes under the plate which holds it down until the hooked ends of the needles receive it. This plate also prevents the latches of the needles from rising up and covering the hooks, as the latches are freed from the loops of the fabric as the needles come forward, the needles being raised by inclines carried by the sliding bar H² (see Figures 3, 4 and 5). The above described parts arranged and combined as above described constitute a machine for making a plain, looped, or knitted fabric.

For narrowing or widening such fabric we employ apparatus constructed as follows:—A bar K supported by two arms secured to the top tie B supports three bearings for the axles of two screws L the outer ends of these axles carry each a rocking lever, the upper ends of which carry a double ended pawl L¹, which drives a toothed wheel. The lower end of the rocking lever is hinged to a link attached to the upper end of a lever which carries a stud O¹, operated by a grooved cam P. There are two boxes M each of which slides on the bar K, and is caused so to slide by the partial revolution of the toothed wheel moved in either direction of motion by drivers L¹. Studs screwed to the box M take into the grooves of the screws L. Each box carries a slide N which has an axle on which a double ended lever N¹ moves, the outer end of which is kept down by a spring shown by dotted lines, the inner end of the lever carrying the ticklers or points. The slide N is attached to the upper end of a rocking lever having its lower end connected by a link with the upper end of a lever provided with a stud O¹ which is operated by the cam P on the cam shaft P¹, the rocking lever being free to move on the shaft O carried by bearings secured to the arm attached to the upper tie bar B, the cam P communicating backward and forward

movements to the points or ticklers. These ticklers besides having the movements just described have also an upward and downward movement imparted to them by the upper end of a lever O^2, which carries a stud at its lower end actuated by an inclined bit O^3, shown by dotted lines on Figure 3, M^1 is a driving arm screwed to the top of each box M. The inner end of this driver falls into a slot in a stud carried by a sliding plate R^2, which covers a fixed slotted plate R^1 screwed to a bar R supported by brackets attached to the top tie bar B. By these means the thread carrier E when depressed is stopped from passing the needle which was previously narrowed by a stud which projects from the back of the thread carrier E dropping into one of the slots of the plate R^1.

Having described the separate movements of the several parts we will now proceed to describe the movements of the machine collectively, commencing with a course drawn from left to right. The thread carrier and thread layer having laid the thread within the hooks of the needles, the needles recede within the sley F which knock over the loops at the needle heads, the needles then advance to receive the thread for the next course, such movements being successively repeated a plain, looped, or knitted fabric will be made, to narrow which the cam shaft I^1 must be thrown into gear by letting the bolt I^2 fall into the catch of one of the plates, between which it slides and which are attached to the bevel wheel before mentioned, at one end, which is effected by withdrawing a wedge from below the bolt I^2 shown at Figure 12. The narrowing cam shaft being in gear, a section of the sleys F and H and work bar G, advance and put the loops on the ticklers, they then recede, the ticklers rise and traverse two or more needles. The sleys again advance, the springs in the sley H are then depressing and take the work back.

Having now described the nature of the said Invention, and in what manner the same is to be performed, we declare that we claim,—

First. The machinery or apparatus for narrowing or widening alternately looped or knitted fabrics, for producing such fabrics without stopping the working of the machine.

Second. The arrangement, combination, and construction of parts herein-before described, constituting our improved machinery or apparatus

for the manufacture of looped or knitted fabrics, substantially as set forth.

In witness whereof, we, the said Henry Willatt and Robert Gee, for ourselves and on behalf of the said John Goss, have hereunto set our hands and seals, this Thirty-first day of August, in the year of our Lord One thousand eight hundred and seventy-one.

HENRY WILLATT. (L.S.)
ROBERT GEE. (L.S.)

Witness,
GEO. JON. ROBINSON,
Patent Office,
Nottingham.

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1871.

A.D. 1871 MAR. 3. N° 573.
WELLATT, GEE & GOSS' SPECIFICATION.

13 SHEETS.
SHEET 1

FIG. 1.

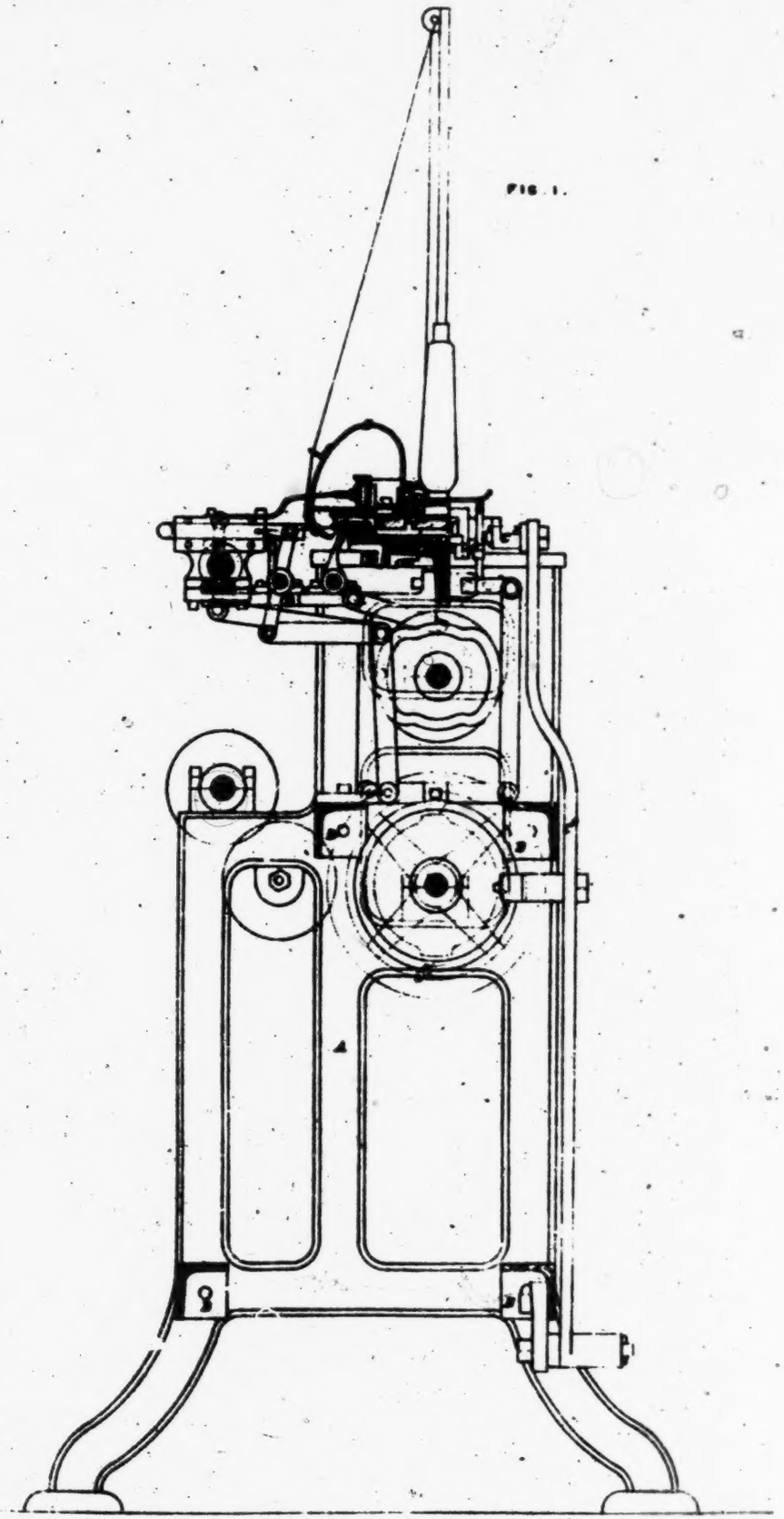
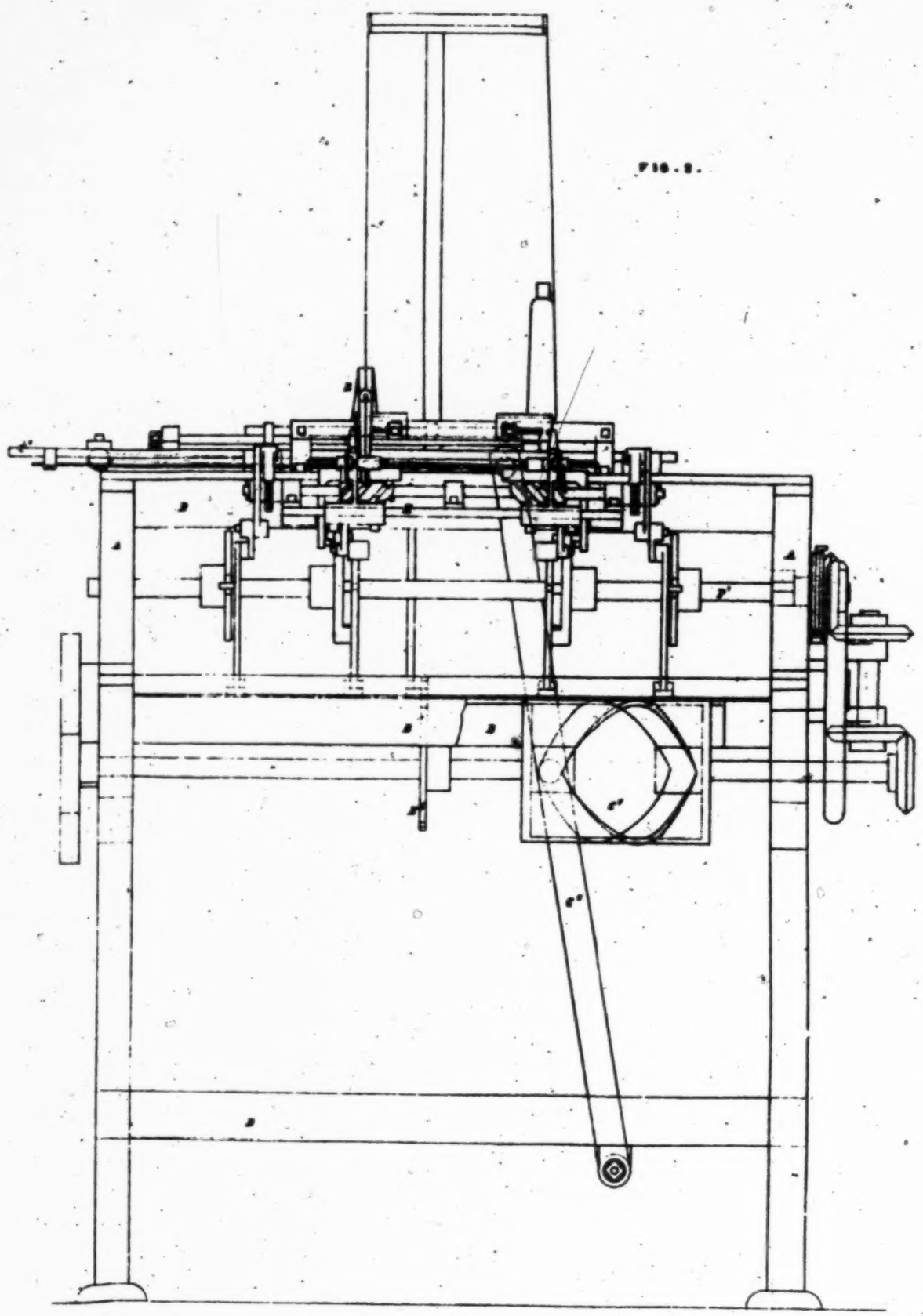


FIG. 2.



The filed drawing is not reduced.

Drawn on Stone by Kirby & Sons

London: Printed by George Edward Eyre and William Spottiswoode, 1871.

792
Dep. T. p. 9

A.D. 1871. Mar. 8. N° 878.
WILLATT, GEE & GOSS' Specification.

13 SHEETS/
SHEET 2

FIG. 8.

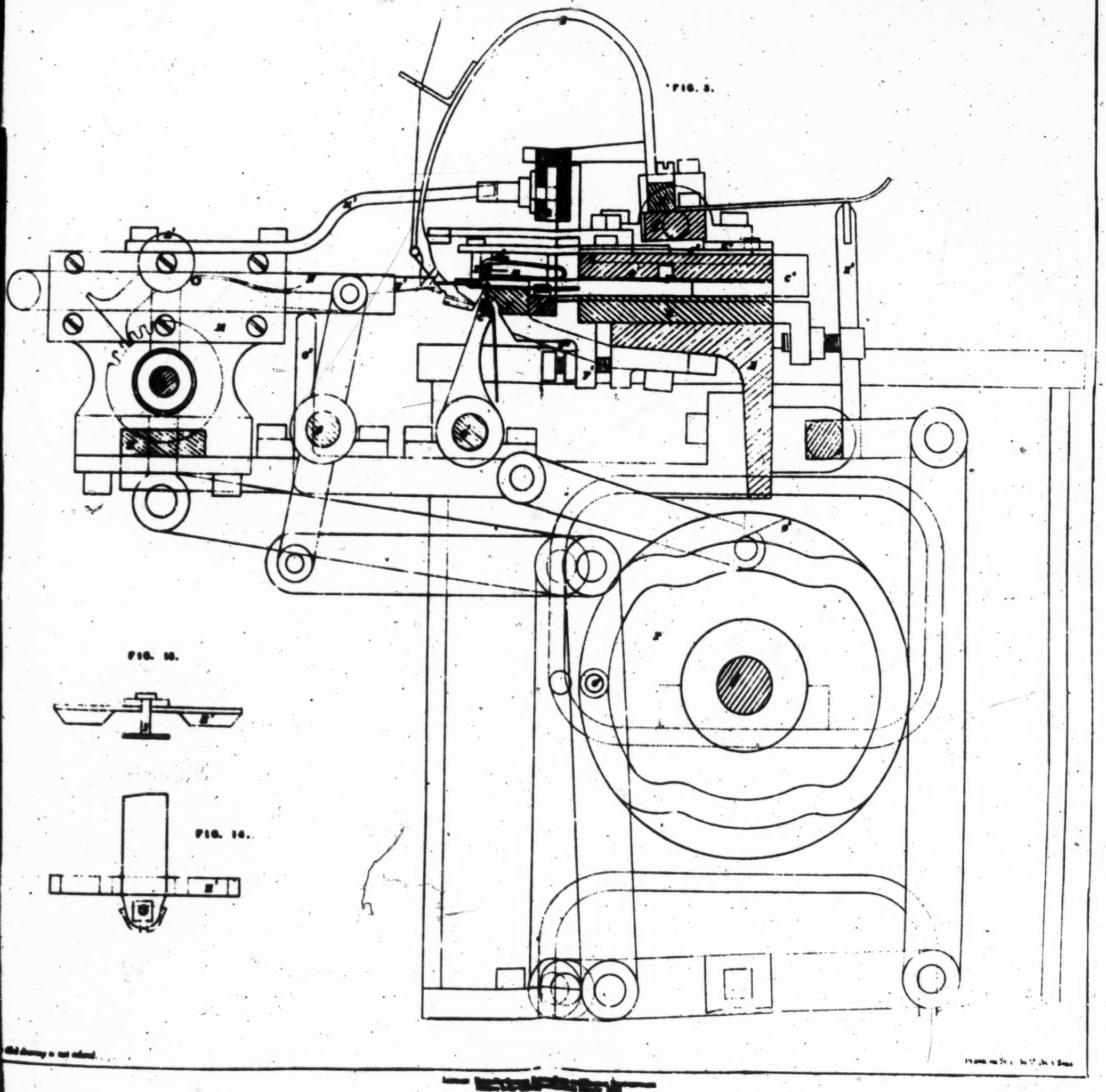


FIG. 10.

FIG. 10.

DEC T. P. 10

A.D. 1871. Mar. 8 N° 573.
WILLATT, GEE & OGLE'S SPECIFICATION.

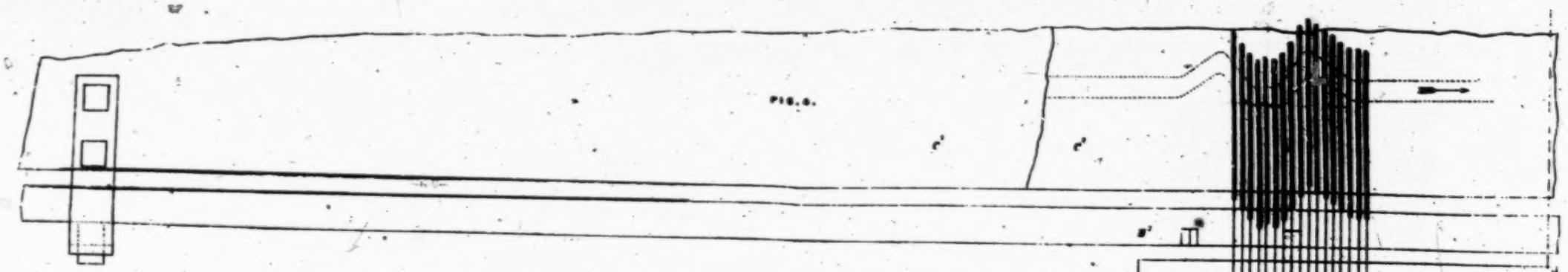


FIG. 6.

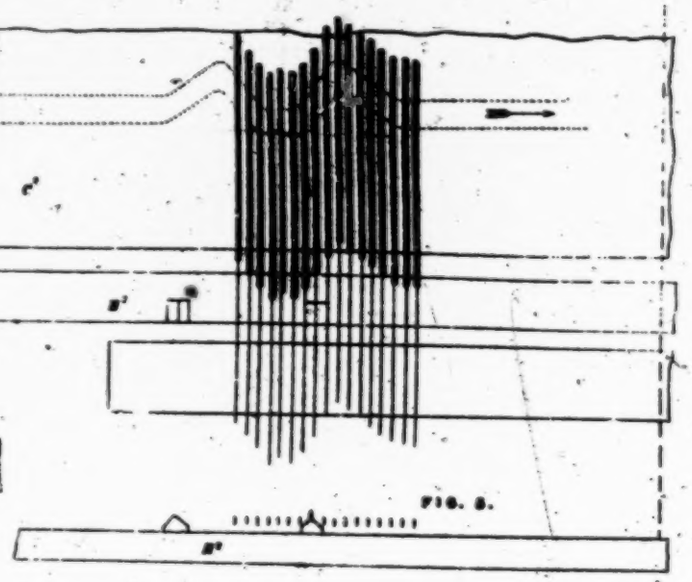


FIG. 8.

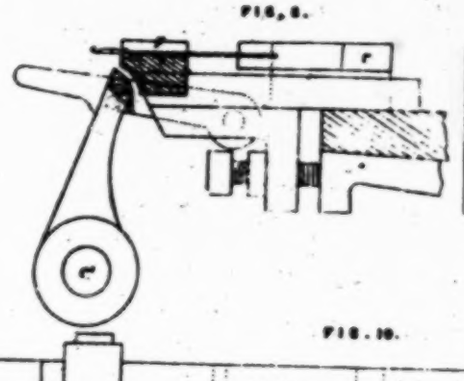


FIG. 4.

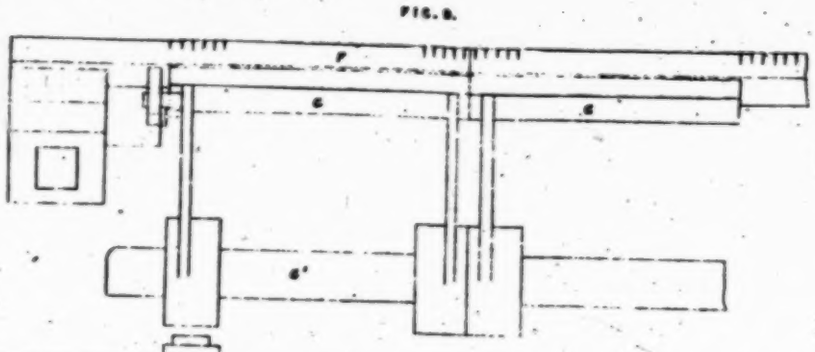


FIG. 5.

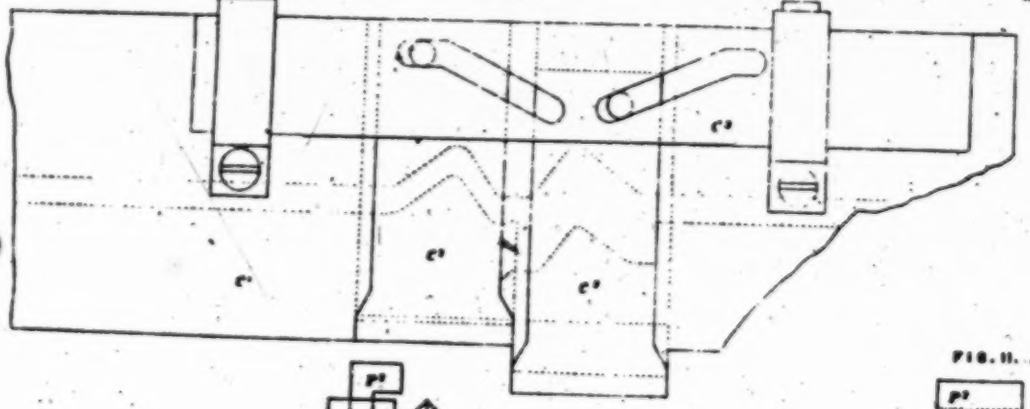


FIG. 10.

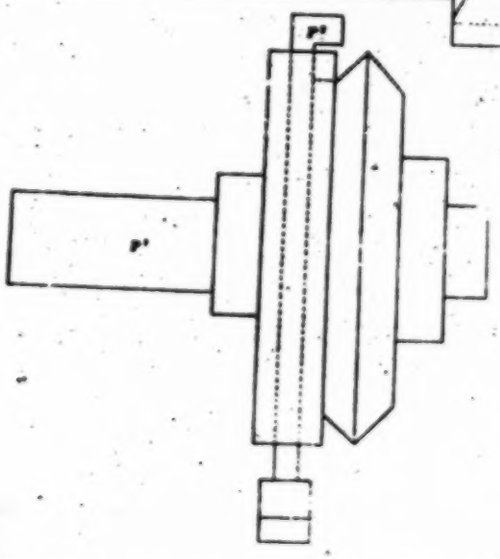


FIG. 12.

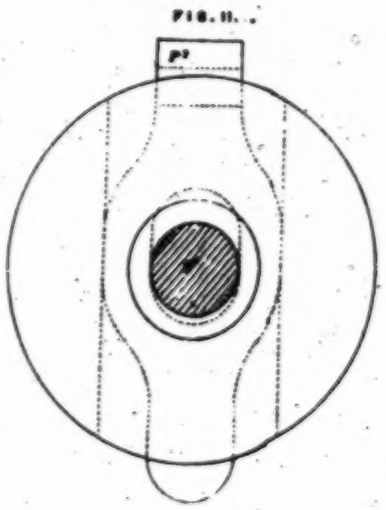


FIG. 11.

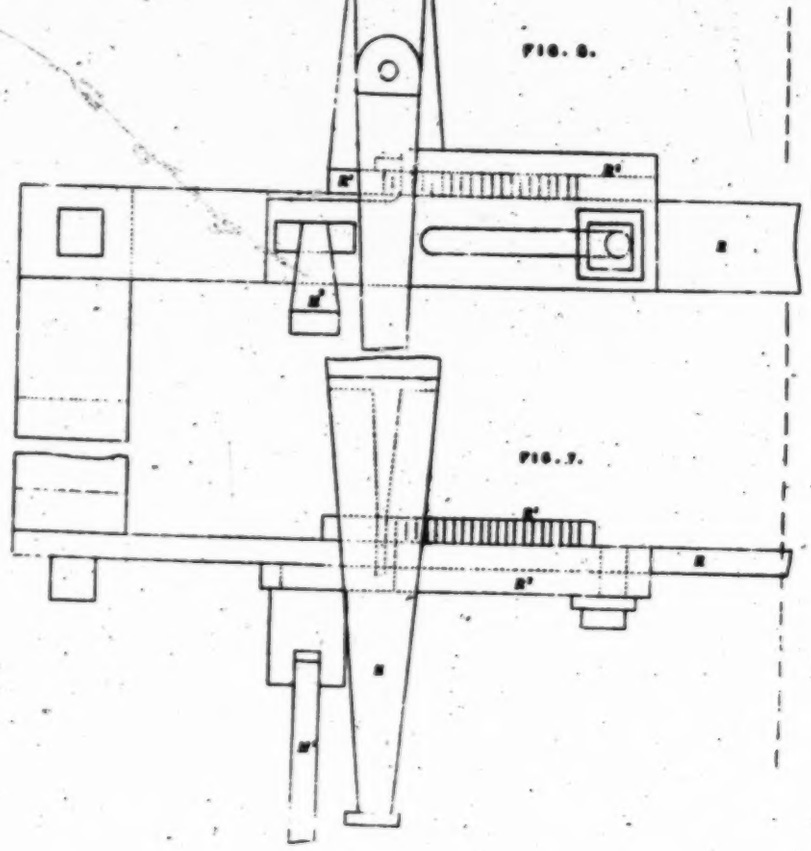


FIG. 9.

FIG. 7.

The whole drawing is not altered.

Printed on Stone by Malby & Sons

DEFENDANT'S EXHIBIT U

794

KAISERLICHES PATENTAMT.

AUSGEGEBEN DEN 8. MAI 1883.

PATENTSCHRIFT

№ 21332

KLASSE 25: Flecht- und Strickmaschinen.

LAUE & TIMAEUS, DRESDNER STRICKMASCHINENFABRIK IN LÖBTAU BEI DRESDEN.

Neuerungen an der Lamb'schen Strickmaschine.

Zusatz-Patent zu No. 18242 vom 29. Juni 1880.

Patentirt im Deutschen Reiche vom 2. December 1881 ab.

Längste Dauer: 28. Juni 1895.

In dem Haupt-Patent ist die Fadenführung und deren Umstellung für hinterlegte Waare dargestellt und beschrieben. Die Einrichtung hat den Zweck, mit den beiden Fäden dergestalt wechseln zu können, dafs der eine oder der andere den hinterlegten Faden bildete. Eine gleiche Umstellung durch einen Hebel zum Wechseln der Faden kann auch bei der Anwendung von mehr als einem Fadenführerpaar benutzt werden, unter Zuhülfenahme der nachstehend beschriebenen Einrichtungen, wodurch das Farbenmuster in hinterlegter Waare in vielfacher Weise variirt werden kann.

Angenommen, die beiden Fadenführer 4 und 5, Fig. 1, seien in Arbeit, so kann deren Stellung zu einander durch den Umstellhebel *a* dergestalt verändert werden, dafs der eine oder der andere Fadenführer der nachfolgende ist und den hinterlegten Faden zuführt. Hierbei stehen dann die übrigen Fadenführer 1, 2, 3 und 6 seitlich von der Nadelbahn aufser Arbeitsstellung.

Es kann nun nicht allein jedes beliebige Paar unter den sechs Fadenführern zum Zusammenarbeiten eingestellt werden, sondern es können auch die beiden Fadenführer eines beliebig gewählten Paares in der oben angegebenen Weise unter einander verstellt werden. Hieraus geht schon hervor, in welcher Mannigfaltigkeit der Wechsel im Farbenmuster bei hinterlegter Waare stattfinden kann.

Die sechs genannten Fadenführer gleiten in den sechs Nuthen 7, 8, 9, 10, 11 und 12, die Fadenführer sitzen an den sechs Zugstangen 13, 14, 15, 16, 17 und 18, deren linksseitiges Ende in den Führungsstücken 19, 20, 21, 22, 23 und 24 befestigt ist.

Diese Führungsstücke arbeiten in den genannten Nuthen zwischen den stufenartig ausgeschnittenen Stücken *b b*, welche durch die Stellschrauben *c c* auf beliebige Entfernung, die sich nach der Breite des Arbeitsstückes zu richten hat, von einander eingestellt werden können. Die Einstellung des betreffenden Fadenführerpaares und die Umstellung innerhalb dieses Paares geschieht durch folgende Einrichtungen:

An einem Ende des Schlittens ist der aufrechte Ständer *d* befestigt, der den Fadenführertreiber bildet und den Umstellmechanismus trägt. Derselbe ist in Fig. 1 in Vorderansicht, Fig. 2 in Endansicht und Fig. 3 im Grundrifs zu sehen. Fig. 4 und 5 geben Vorderansichten, Fig. 6 eine Seitenansicht desselben in vergröfsertem Mafsstabe wieder.

In dem Ständer oder Fadenführertreiber *d* sind zur Führung der beiden Schienen *f g* in ihren Langlöchern vier Führungsstifte *e* eingeschraubt. Die Schienen können auch durch den Umschalthebel *a* in verticaler Richtung zu einander verstellt werden. Zwischen Ständer *d* und Führungsschienen *f g* sind zwei Gleitstücke *h h* angebracht. Diese Gleitstücke sind mit nach hinten vorstehenden Mitnehmern *m m* versehen, die, zwischen den Nasen eines der Führungsstücke 19 bis 24 arbeitend, den zu diesem Führungsstück gehörigen Fadenführer hin- und herschieben.

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Die Gleitstücke *h k* sind mit zwei Löchern versehen; ebenso sind die Schienen *f g* mit Löchern versehen, die so zu einander stehen, dafs durch Einstecken der Knöpfe *l i* mit ihren beiden Stiften *o r* in zwei zusammengehörende Löcher der Schienen *f g* und in die Löcher der Gleitstücke *h k* die Schienen *f g* und Gleitstücke *h k* mit einander verbunden werden, so zwar, dafs durch Umstellung der Schienen in verticaler Richtung mittelst Hebels *a* die Gleitstücke *h k* einander genähert oder von einander entfernt werden können.

Diese beiden verschiedenen Stellungen sind in den Fig. 4 und 5 dargestellt. Der Zweck dieser Verstellung ist bereits im Haupt-Patent angegeben. Durch diese Verstellung wird der Mitnehmer *m* z. B. aus der Stellung zwischen den Nasen *p p* in die Stellung zwischen die Nasen *q q*, Fig. 7, gebracht, und ebenso wechselt der Mitnehmer *n* seine Stellung zwischen den Nasen des Führungsstückes desjenigen Fadenführers, der gleichzeitig sich in Function befindet. Die Folge dieser Veränderung ist der Wechsel in der Reihenfolge der beiden arbeitenden Fadenführer über die Arbeitsbahn, also der gewünschte Wechsel, dafs der bisher den hinterlegten Faden bildende Faden nunmehr im Arbeitsstück oben auf zu liegen kommt und der bisherige obere Faden hinterlegt wird, oder was dasselbe sagt, als zweiter Faden die Nadelbahn passirt.

Will man einen der bisher in Function gewesenen Fadenführer ausschalten und dafür einen anderen Fadenführer in Function treten lassen, oder will man beide Fadenführer ausschalten und dafür zwei beliebig andere Fadenführer einstellen, so geschieht dies einfach durch Umstellen des einen Knopfes oder der beiden Knöpfe *l i* aus dem einen Paar Schienenlöcher in ein anderes Paar; dadurch wird das Gleitstück und sein Mitnehmer des betreffenden Knopfes in die Bahn zwischen die Nasen des oder der nunmehr in Function tretenden Fadenführer eingestellt.

Wie aus Fig. 7 und aus den Querschnitten, Fig. 8 und 9, ersichtlich, sind die Nasen *p q* je auf der Fläche eines an dem Führungsstück (19 bis 24) gelagerten Balanciers *x* angebracht; gleichzeitig ist dieses Führungsstück mit einer Schiene *s* überdeckt, die sich in ihren Langlöchern auf den Stiften *t* des Führungsstückes verschieben kann. Diese Verschiebung erfolgt jedesmal, wenn die Schiene *s* am Ende einer halben Tour an den eingestellten Theilen *b b* antrifft, und hat diese Verschiebung der Schiene *s* den Zweck, eines ihrer Löcher *u* über einen der Ausschnitte *v* in den Führungsstücken einzustellen, damit der Balancier *x* sich um so viel drehen kann, dafs einer seiner Vorsprünge *w* an seiner hinteren Seite durch ein Loch *u* der Schiene in einen Ausschnitt *v* des Führungsstückes eintreten kann, wodurch erreicht wird, dafs der von der Schlittenbewegung beeinflufste Mitnehmer *m* oder *n* den etwas gröfseren Schlittenlauf mitmachen kann, während der Lauf des Fadenführers auf sein geringes Mafs beschränkt bleibt.

Fig. 10, 11 und 12 sind Seiten- und Oberansicht und Querschnitt der Verbindung zwischen Zugstange und Fadenführer.

In dem Haupt-Patent sind die Einrichtungen dargestellt und beschrieben, um die Oesenbetten oder Abschlagkämme entweder gleichzeitig oder hinter einander durch einen Mechanismus zu verstellen bezw. zu senken. Um dieses Senken hinter einander bewirken zu können, so zwar, dafs der eine Abschlagkamm unabhängig von dem anderen gesenkt oder gehoben werden kann, kommt für den einen Abschlagkamm der Winkelhebel *a*, Fig. 13 und 14, für den anderen Abschlagkamm der Hebel *b*, Fig. 13 und 15, zur Anwendung.

Winkelhebel *a* dreht sich um *c*, sein Langloch umfafst den Stift *d* auf Schiene *e*, die an ihren Enden so geführt ist, dafs sie sich lediglich in horizontaler Richtung verschieben läfst; da die Stifte *f* des Abschlagkammes in die schräg gestellten Langlöcher der Schiene *e* eingreifen, so mufs bei der horizontalen Verschiebung der letzteren der Abschlagkamm eine verticale Verschiebung mitmachen, wobei er mit seinen Langlöchern *g* über den Stiften *h* gleitet.

Dieselbe Einrichtung ist für den gegenüberliegenden Abschlagkamm getroffen, nur mit dem Unterschiede, dafs hier der Hebel *b* mit seinem Handgriffe nach unten vorsteht.

Patent-Ansprüche:

Die beschriebenen Neuerungen an den durch P. R. No. 18242 geschützten Einrichtungen:

1. Zur Herstellung hinterlegter Waare die dargestellte Anordnung und Führung einer vielfachen Zahl von Fadenführern gegenüber der in dem Patente No. 18242 zur Herstellung hinterlegter Waare angegebenen, aus zwei Fadenführern bestehenden Gruppe.
2. Der in der verlängerten Achse der Strickmaschine angeordnete Mechanismus zum Antrieb der in Arbeit befindlichen Fadenführergruppe und zur Wechselstellung dieser Gruppe unter sich, sowie zur beliebigen Auswechselung dieser Gruppe oder eines Fadenführers dieser Gruppe mit den aufserhalb der Nadelbahn in Ruhestellung befindlichen Fadenführern.
3. Die in den Fig. 13, 14 und 15 dargestellte Einrichtung zum getrennten Herablassen der Abschlagkämme durch Hebel *a b*.

Hierzu 3 Blatt Zeichnungen.

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BERLIN. GEDRUCKT IN DER REICHSDRUCKEREI

[fol. 796] DEFENDANT'S EXHIBIT U

Translation

German Patent No. 21,332

Laue & Timaeus, Dresdner Strickmaschinenfabrik in Loebtau b/Dresden

Improvements on the Lamb Knitting Machine

Suppl. Patent to No. 18,242 of June 29, 1880. Patented in Germany: December 2, 1881. Valid, until June 28, 1895

In the main patent the thread guiding and its transposition for reinforced fabric is shown and described. The object of the device is to change with both threads in such a manner that either the one or the other forms the reinforcing thread. A like transposition by means of a lever to change threads may also be used when employing more than one pair of thread carriers with the help of the following described devices, whereby it is possible to produce a large variety of color designs in reinforced fabrics.

Assuming that both thread carriers 4 and 5, Fig. 1, are operating, their position to each other may be changed by means of the transposing lever a, in such a manner that either the one or the other thread carrier follows after and feeds the reinforcing thread. In this case the remaining thread carriers 1, 2, 3 and 6 stand inactive outside of the needle bar.

Not only may any selected pair of the six thread carriers be adjusted to work together, but both thread carriers of any selected pair can also change their position to each [fol. 797] other in the above described manner. This already shows, what a great variety of changes in the color designs in reinforced fabric may be obtained.

The six mentioned thread carriers, slide in the six grooves 7, 8, 9, 10, 11 and 12, and are fastened on the six draw-bars 13, 14, 15, 16, 17 and 18, whose left hand ends are fastened to the guide pieces 19, 20, 21, 22, 23, and 24.

These guide pieces operate in the aforementioned grooves between the stepped stops b,b, which by means of adjusting screws cc may be positioned at various distances from one another, depending on the width of the fabric to be made. The positioning of the thread carrier pair in

question and the transposition within this pair is done by the following devices:

On one end of the slide bar the upright post d is fastened, which acts as the thread carrier driver and carries the transposing mechanism. Same is to be seen in Fig. 1, front view, Fig. 2, end view, Fig. 3 plan view. Fig 4 and 5 give front views, Fig. 6 a side view of same in an enlarged scale.

Into the upright post or thread carrier driver d are screwed four guide pins e, engaging elongated holes of both rods f and g, thereby guiding motion of same. The vertical position of these rods may also be changed in relation to one another by means of the transposing lever a. Between post d and guide rods f,g two slide blocks h,k, are provided. Projecting from the rear and fastened to these slide blocks are driving pins m,n which, working between the noses of one of the guide pieces 19 to 24, move forth and back the thread carrier belonging to this guide piece. The slide blocks h k are provided with two holes, the guide rods [fol. 798] f g are likewise provided with holes, in such relation to one another that when the knobs l i engage with their two pins o r in two complementary holes of rods f g and slides h k, the guides f g and slides h k are tied together, in such a manner that by a change of the vertical position of the guide rods f g by means of lever a, the slides h k may be brought nearer or farther from each other.

These two different positions are shown in Figs. 4 and 5. The reason for this transposition has already been stated in the main patent. Thru this transposition the driving pin m, for instance, is brought out of position between the noses p p into position between the noses q q, Fig. 7. Also driving pin n changes its position between the noses of the guide pieces of the other thread carrier, which functions at the same time. The consequence of this shifting is the change in the sequence of operation of both thread carriers over the needle bed, i.e. the desired change that the thread, heretofore used as the plaiting or reinforcing thread, now comes to lay on top in the fabric, and the heretofore top thread now plaites or reinforces, or in other words, passes across the needle bed as the second thread.

If it is desired to disengage a thread carrier, heretofore operating, and engage another one in its place, or to dis-

engage both thread carriers and engage any two other ones in their places, it is simply done by transposing the one knob or both knobs l i from one pair of rod holes to another pair; thereby causing the slide piece and its driving dog to be shifted into the path between the noses of the new carrier rod which is now to function.

[fol. 799] As shown in Fig. 7 and cross sections 8 and 9, noses p and q are both fastened to balancing members x, which in turn is pivoted to guide piece (19 to 24); the guide piece is also covered with rod s which is movable in its elongated holes on the t, fastened to the guide piece. Such longitudinal movement occurs each time when the rod s at the end of each stroke (half cycle of carrier rod) strikes the stops b b. The purpose of this movement of rod s is to register one of its holes u over one of the cutouts v in the guide piece, so that the balancing piece x can turn an amount sufficient for one of its projections w to enter thru hole u in rod s into the cutout v of the guide piece. This permits the driving pins m or n fastened to the carrier driver d to travel the full length of the driver, while the travel of the thread carriers is shorter (and varying, limited by the stepped stops b b).

Figs. 10, 11, and 12 are side and top views and cross section, showing connections between draw bar and carrier.

In the main patent are shown and described the devices to lower the loop beds or knocking over bit beds either together or alternately by means of a mechanism. For this alternate lowering, so that the one knocking over bit bed may be raised or lowered independently of the other, angle lever a, Fig. 13, and 14, is provided for the one bed, and lever b, Fig. 13 and 15, for the other.

Angle lever a turns about c, its elongated holes engaging pin f on rod e, which is guided at its end so that it may be moved horizontally only. As the pins f of the knocking over bit bed engage the diagonally elongated holes of rod e, [fol. 800] when rod e is moved horizontally, the knocking over bit bed must make a vertical movement, being guided by pins h engaging elongated holes g of the knocking over bit bed.

The same device is provided for the opposite knocking over bit bed, only with the exception that here the lever b has a downwardly protruding handle.

Claims

The described improvements on the P. R. #18,242 protected devices:

1) For the manufacturing of reinforced fabric the described arrangement and guiding of a multiplicity of carriers as against a group of only two thread carriers as set forth in Patent 18,242 for manufacturing reinforced fabrics.

2) The mechanism applied in the direction of the long axis of the knitting machine for the operation of the thread carriers and for the changing of carriers within this group, as well as for any desired exchange between this group or one carrier of this group and the thread carriers standing inactive outside of the needle bed.

3) The device shown in Figs. 13, 14 and 15 for the separate lowering of the knocking over bit beds by means of levers a and b/.

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DEF. U. p. 3.

LAUE & TIMAEUS, DRESDNER STRICKMASCHINENFABRIK
IN LÖBTAU BEI DRESDEN.

Neuerungen an der Lamb'schen Strickmaschine.

Blatt I.

Fig 1.

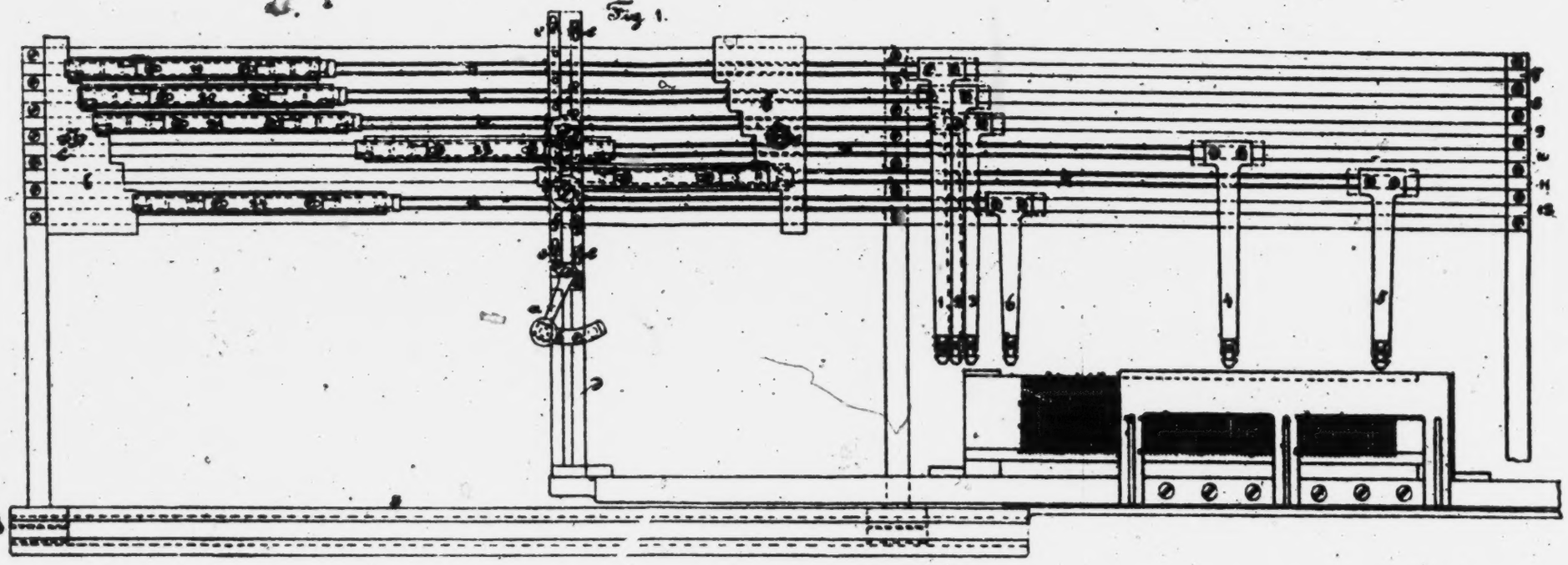


Fig 2.

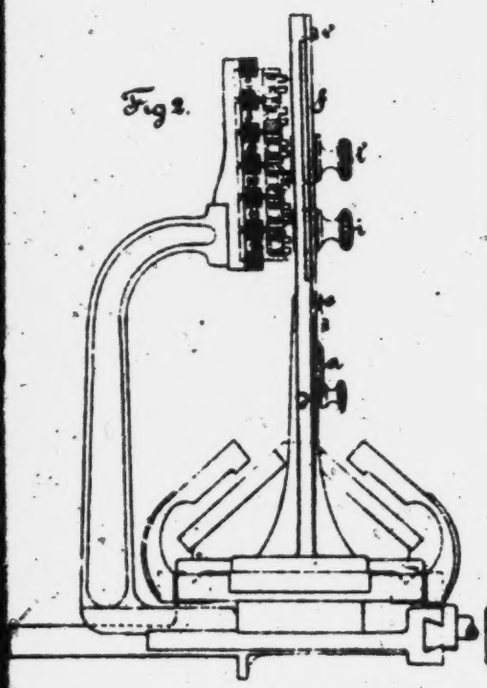
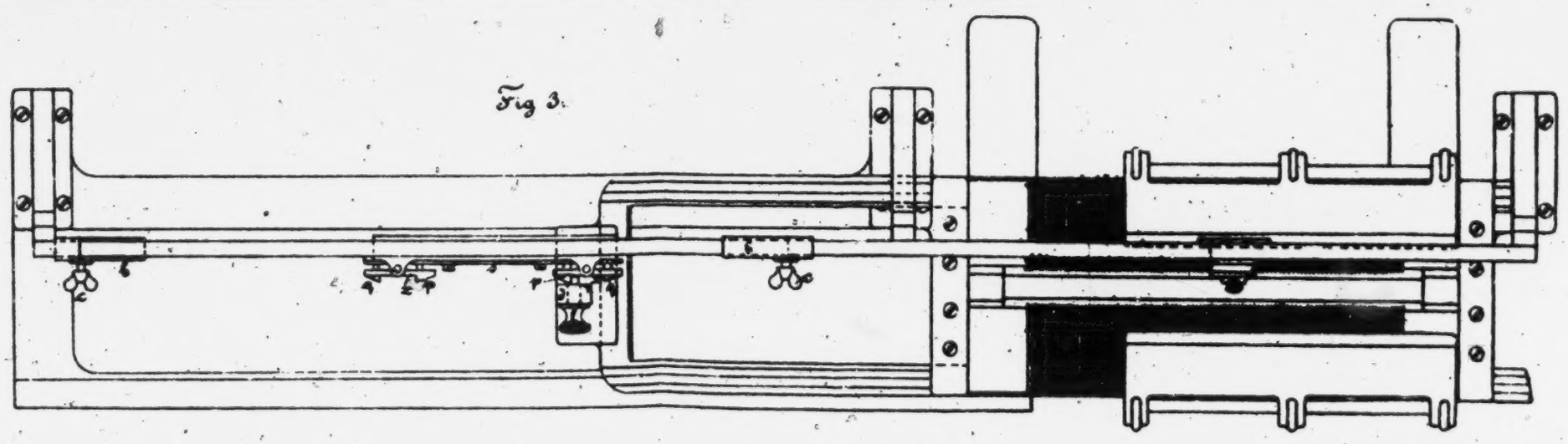


Fig 3.



Zu der Patentschrift

№ 21332.

PHOTOGR. DRUCK DER REICHSDRUCKEREI.

LAUE & TIMAEUS, DRESDNER STRICKMASCHINENFABRIK
IN LÖBTAU BEI DRESDEN.

Neuerungen an der Lamb'schen Strickmaschine.

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DEF. U. p. 4.

Blatt II.

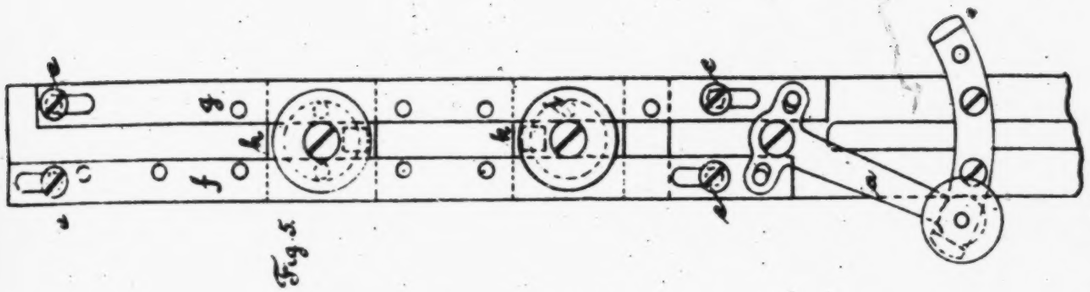
Fig. 5.

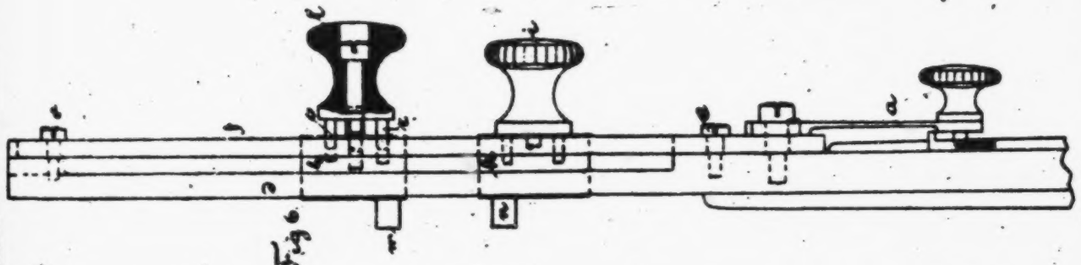
Fig. 6.

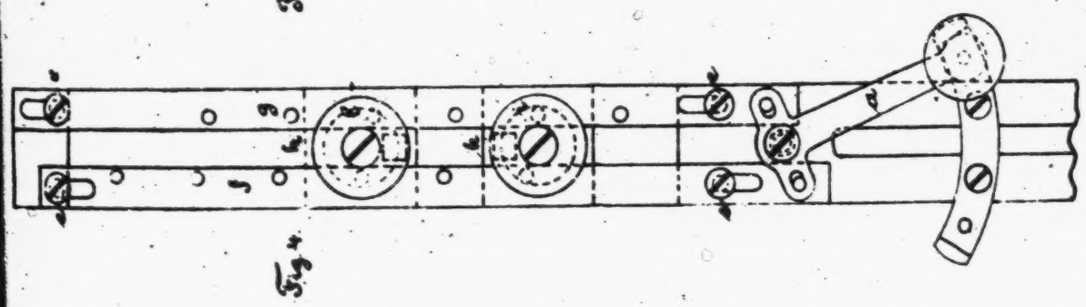
Fig. 7.

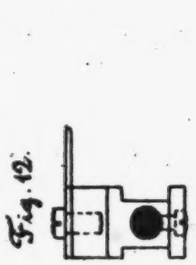
Fig. 12.

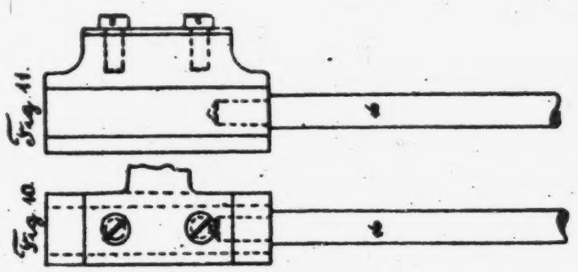
Fig. 11.

Fig. 10.

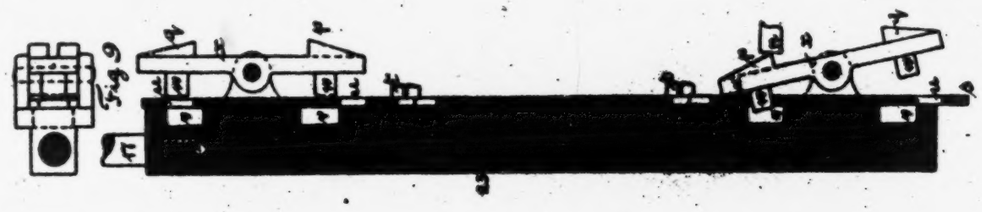
Fig. 9.

Fig. 8.

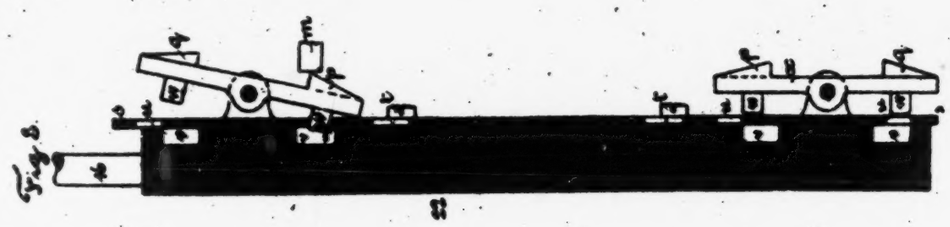
Fig. 13.

Zu der Patentschrift

№ 21332.

PHOTOGR. DRUCK DER REICHSDRUCKEREI.

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Der. U. p. 5

LAUE & TIMAEUS, DRESDNER STRICKMASCHINENFABRIK
IN LÖBTAU BEI DRESDEN.

Neuerungen an der Lamb'schen Strickmaschine.

Blatt III.

Fig 13

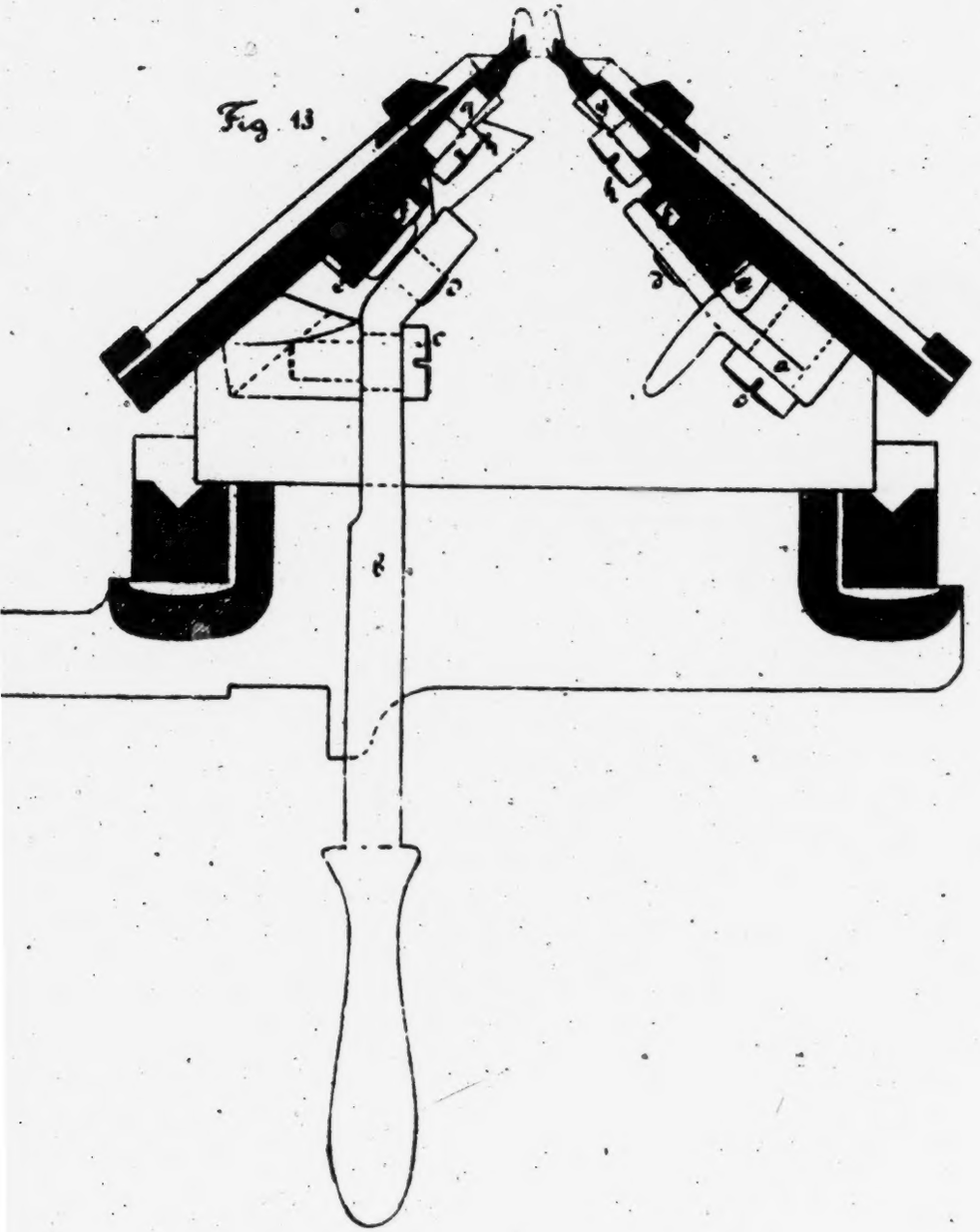


Fig 14.

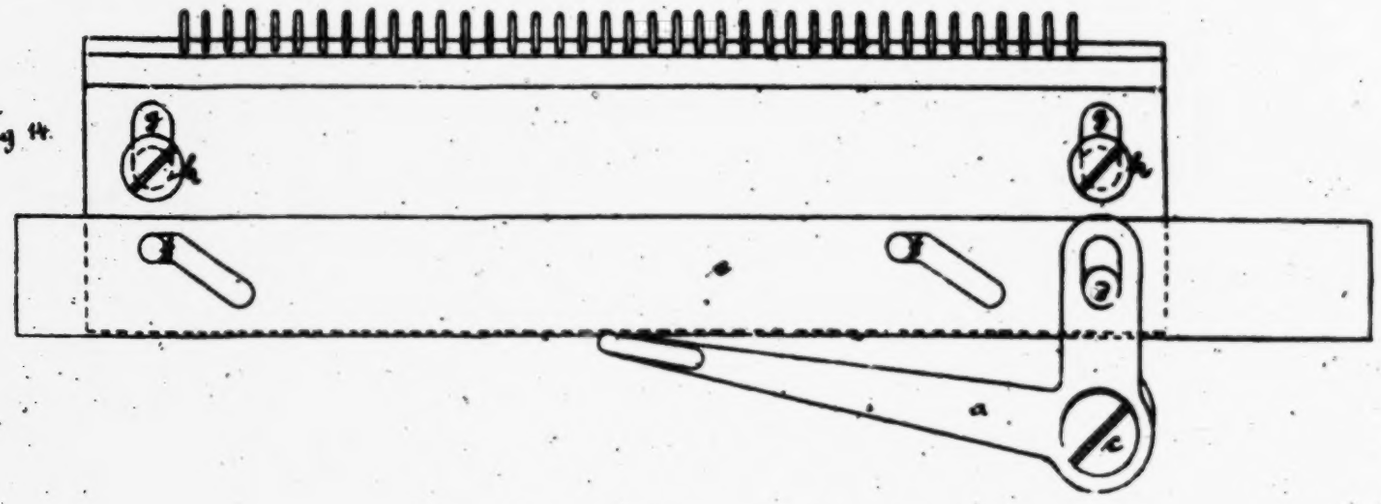
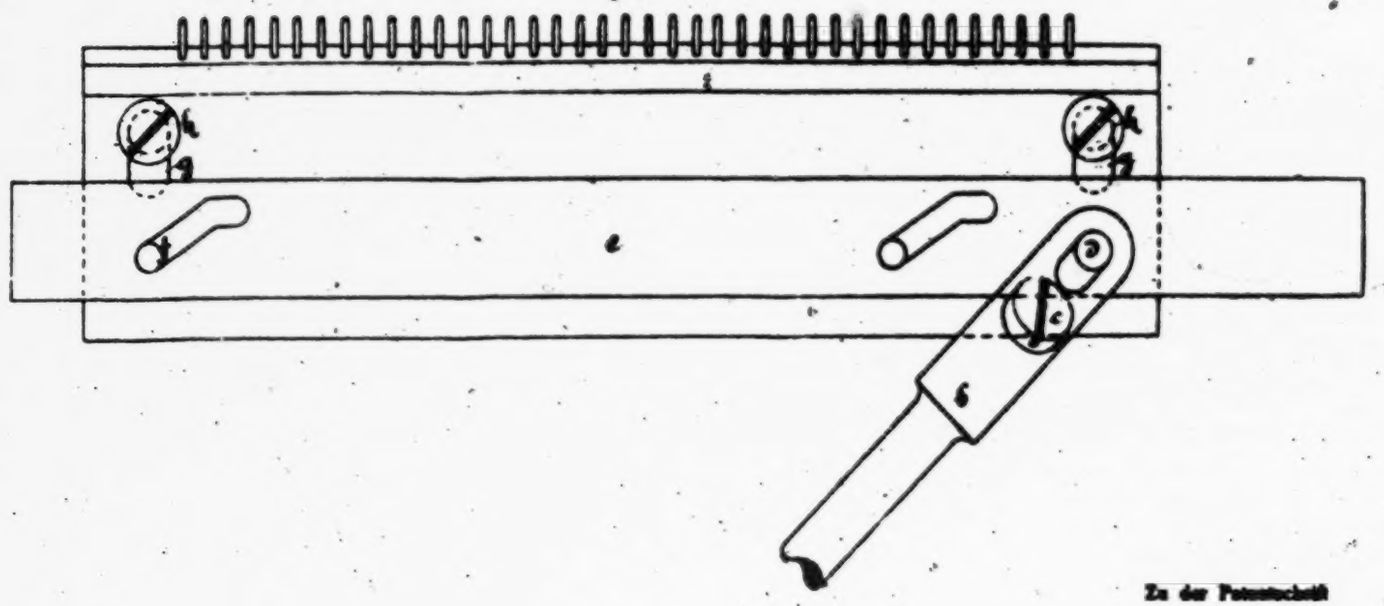


Fig 15



Zu der Patentschrift

№ 21332.

PHOTOGR. DRUCK DER REICHSDRUCKEREI.

KODAK SAFETY FILM

DEFENDANT'S EXHIBIT V 804

A.D. 1887.—N° 13,905.

Black's Impts. in Elastic Looped Fabrics and in the Means for Producing the same.

COMPLETE SPECIFICATION.

Improvements in Elastic Looped Fabrics and in the Means for Producing the same.

I, ARTHUR JOHN BLACK of Stoney Street, Nottingham in the County of Nottingham, Hosiery Manufacturer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

This invention relates to the manufacture of elastic looped fabrics with a looped pile on the back of the fabric, and extending over a portion thereof, or the whole of the surface, according to the nature of the article to be produced. This class of fabric has been manufactured for some years past on circular, straight, and warp machines, but up to this time, no attempt, so far as I know, has been made to introduce the pile surface into fashioned goods, a fixed catch having been required at the opposite selvages to hold the pile thread apart from the ground thread.—It is manifest, however, that where the selvage needles are constantly shifted to produce the shaping of the goods, such fixed catches were inadmissible.

To produce fashioned underclothing with a pile surface, according to my invention, I take any well-known fashioning machine, for example, the "Paget," provided with a second thread carrier slide, which is controlled in its movements, like the ordinary thread carrier slide, by stops worked automatically in any well known manner. I also employ a peculiar construction of double-throated sinkers to operate upon the two threads, which are laid simultaneously on the needles, and by this means, I indent the threads unequally, so as to form loops of two different sizes, the larger loop being the pile loop.

The threads will, by the peculiar form of the sinker, be laid on the needles at a distance apart equal to the distance between the two throats.

In the accompanying drawings,

Fig. 1 shews in sectional elevation the principal parts of a Paget fashioning knitting machine, modified to suit the purpose of this invention.

Fig. 2 is a front elevation, shewing the front thread carrier bar and slide, with thread carrier attached thereto, illustrating the manner of driving and stopping the same.

Fig. 3 is a diagram shewing, in plan view, 7 needles and 8 sinkers, and the relative position occupied by the threads of the two carriers, previous to, and during the traverse of the carriers.

Fig. 4. shews, detached, the form of the vertical sinker designed for use in the Paget machine, the same being drawn to an enlarged scale.

A, Fig. 1, is a portion of the main framing of the machine, B the traversing slide which carries the driving catches *b b*, and to which is also fitted the incline *b* for depressing the sinkers. These sinkers are arranged vertically as shewn at C, and

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they are supported in grooves formed in the back of the fixed rail A^1, and in the front of the presser bar D.—E E are the needles arranged horizontally, and carried by the needle bar E^1.

A^2 is a fixed bar which forms a race for the ordinary thread carrier slide F, and on the face of the bar A^1 is formed a race for a slide carrying the additional thread layer G, which thread layer is required for the production of a pile surface.—H is the knocking-over bar carrying the knocking-over bits *h*, between which the needles E slide to perform the knitting action.

This sinker, it will be seen, has two throats e e^1, of different depths, the point of entrance to both of which is in the same vertical plane. The deeper throat e is intended to receive the ground thread, and the shallower throat e^1, the pile thread.

The dip of the thread carriers F and G is so arranged with respect to the sinkers, that the thread carrier F will lay its thread under the point of entrance to the deeper throat e, as shown in Fig. 1, while the thread carrier G will lay its pile thread immediately below the point of entrance to the shallower throat e^1.

In rear of the point of entrance to the throat e, the nob dividing the two throats is inclined upwards. This provides for the taking of the ground thread from its carrier with certainty, even though the thread carrier is advanced only one needle beyond the selvage sinker. A good selvage is thus ensured for the fashioned work, and by the use of this sinker, in combination with a pile thread carrier suitably controlled in the length of its traverse, the limits of the pile surface may be varied at the pleasure of the workman.

As the sinkers, charged with the ground and pile threads, are depressed, they will bring down these threads upon the needles, and, continuing their descent, they will first force down the pile thread to form loops between the needles, and then, in completing their descent, act upon the ground thread in the ordinary manner, extending, at the same time, the length of the loops of the pile thread. This double action of the sinkers will be clearly understood by reference to the Diagram Fig. 5, which represents the sinker in its lowest position between the needles.

The needles are now drawn back during the rising of the sinkers, the loops being thereby moved towards the heads of the needles. The movement of the needles brings their beards under the action of the presser D, as shown in Diagram Fig. 6, and the further back movement of the needles will bring the knitted work over the beards, and cause the new loops to be knitted into the work by the subsequent action of the knocking over bits *h*, as illustrated at Diagram Fig. 7.—The vertical movements of the sinkers is effected as usual, that is to say, they are forced down by the incline b^1, on the slide B, to their lowest position (see Fig. 5), and raised to their highest position by the lifting bar I, to clear the work on the needles, and depressed to the position of Fig. 1, ready to receive the threads by means of the bar K.

From the foregoing description it will be understood that, by reason of this new formation of the sinkers, the two threads will, by the descent of the sinkers, be relegated to their respective positions on the needles, and will be differently indented, the pile thread being forced down deeper between the needles than the ground thread in the act of indenting.—In all other respects, the knitting operation proceeds as heretofore. Thus, the fashioning of the goods, or the stopping of the pile thread carrier, to limit its course, when patches of pile are to be formed, will be effected by the well known means common to fashioning and splicing machines.

The fabrics which I propose to produce with a pile surface, or a partial pile surface, are Gent's and children's shirts, pants, trousers, drawers, hose, and half hose, and combinations of shirt and pants known as "combinations"; also Ladies' and children's vests, drawers, combinations, and hose.

When it is desired to thicken a part, say, for example, on the chest and back of goods, such as Gent's and children's shirts and combinations, Ladies' and children's vests and combinations, I arrange for the pile to be formed thereon by adjusting the stop inclines of the pile thread carrier to suit the width of pile surface required.

In adapting my invention to what is known as the Cotton machine, which is provided with horizontal indenting and dividing sinkers, I form the sinkers as shown

at Figs. 8, C being the indenting or jack sinker, and C* the dividing sinker.—In other respects, the mechanism will remain unaltered, except that the incline on the travelling slide will be required to give a longer movement than usual to the sinkers. The means for securing this extended movement is shewn in the sectional elevation Fig. 9, which represents the principal parts of the well known Cotton machine.

It will be obvious that the position of the deep and shallow throats in the illustrated sinkers may be reversed, as shewn in Fig. 10, where the front and higher throat will take the thread for the ground work, while the lower and rear throat will take the thread for the pile.

Having now particularly described and ascertained the nature of my said Invention, and in what manner the same is to be performed, I declare that what I claim is:—

The adaptation to fashioning knitting machines, of sinkers constructed as described, whereby they will take, simultaneously, from two thread carriers travelling in the same vertical plane, two threads; separate them so as to ensure their proper delivery onto the needles, and indent the same on the needles at different depths, so as to produce a pile surface at any desired part of the fashioned knitted goods.

Dated this 12th day of July 1888.

NEWTON & SON,
Agents for the Applicant.

LONDON: Printed for Her Majesty's Stationery Office,
By DARLING AND SON, LTD.

1888.

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A.D. 1887. Oct 13 Nº 13,905.

807 BLACK'S Complete Specification.

SHEET 1.

Fig: 1.

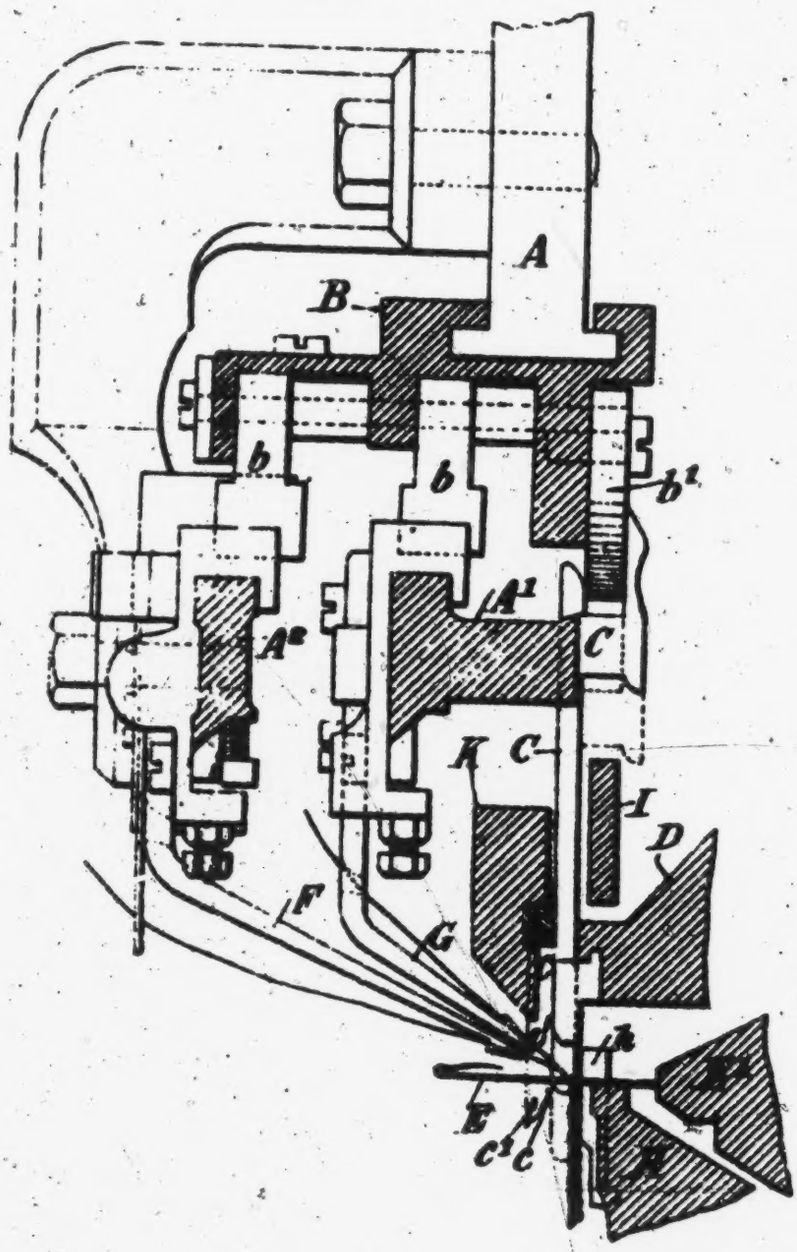
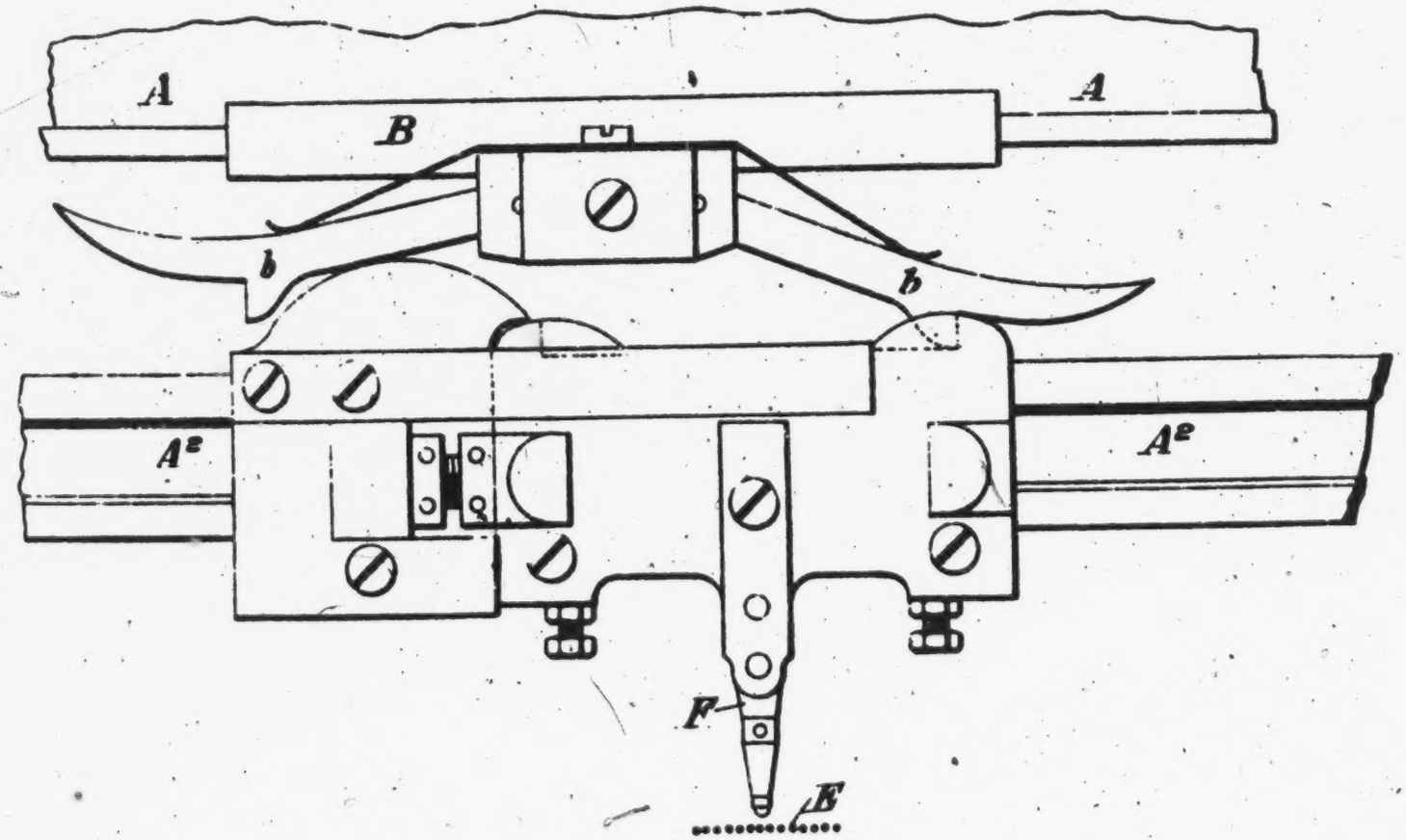


Fig: 2.



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A.D. 1887. Oct. 13. N° 13,905.

809 BLACK'S Complete Specification.

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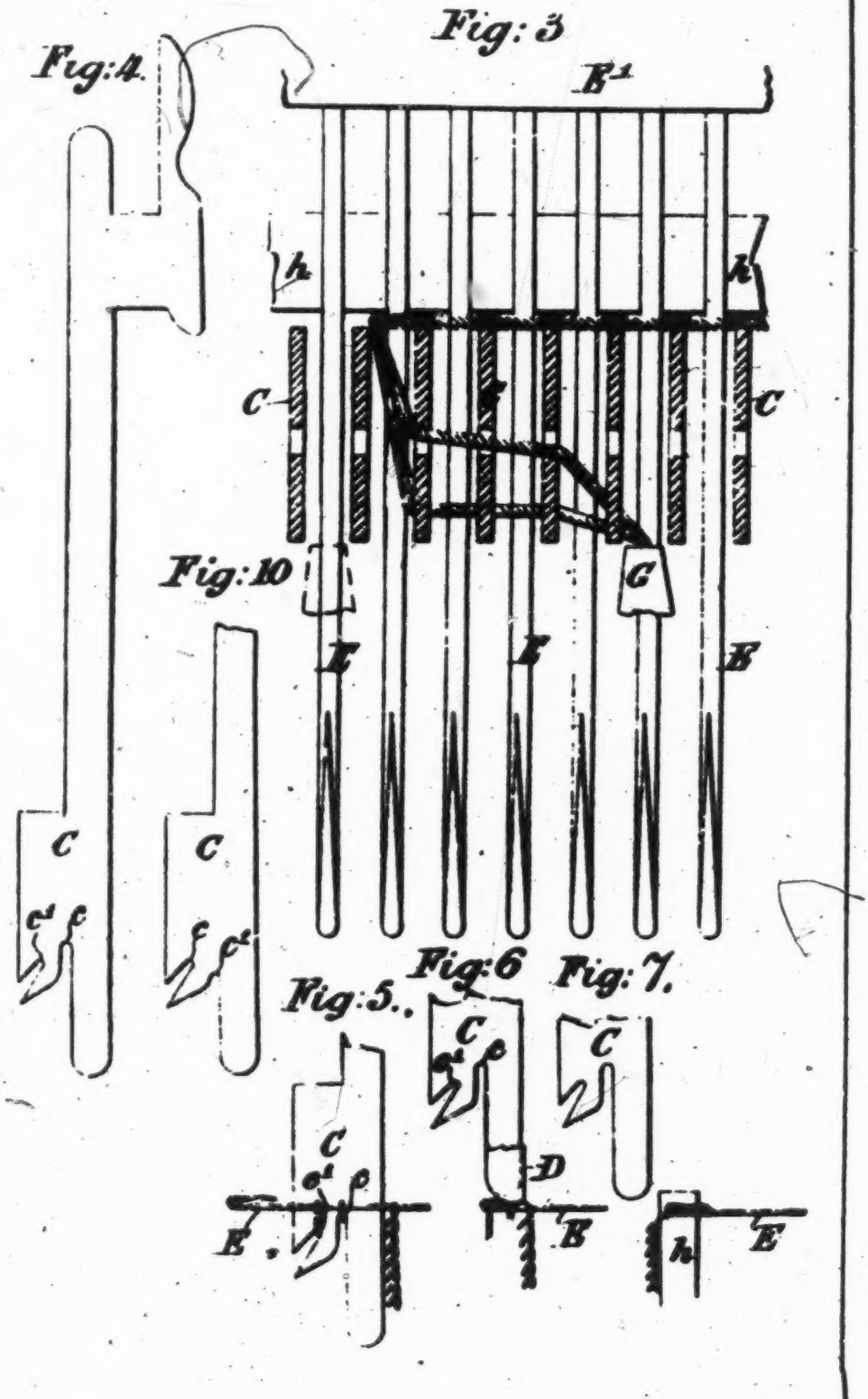

13,905 of 1887

4 SHEET
SHEET 4

Figs: 8

Fig: 9.

DEFENDANT'S EXHIBIT W 811

N° 19,627 A.D. 1891

Date of Application, 12th Nov., 1891
Complete Specification Left, 12th Aug., 1892—Accepted, 17th Sept., 1892

PROVISIONAL SPECIFICATION.

Improvements in the Type of Knitting Machinery generally known in the Trade as "Cotton's."

We, JAMES HENRY WOODWARD, and FREDERICK SHAW, both of Lee Works, in the Town and County of Nottingham, Hosiery Machinists, do hereby declare the nature of this invention to be as follows:—

The chief object of this invention is to obviate the necessity for the attendant who has the machine in charge, having to manipulate the racking arrangement at both ends of the frame after each set of goods or parts of goods has been completed.

At one end only of the machine we fix a worm frame carrying two separate travelling slides.

One portion of the screw is cut with a left hand thread, the other portion with a right hand thread, so that when the screw is revolved the travelling slides move in opposite directions.

To these travelling slides are fixed the stops controlling the various thread carriers and the brackets governing the movements of the narrowing rods.

Dated this 11th day of November 1891.

J. H. WOODWARD.
F. SHAW.

COMPLETE SPECIFICATION.

Improvements in the Type of Knitting Machinery generally known in the Trade as "Cotton's."

We, JAMES HENRY WOODWARD, and FREDERICK SHAW, both of Lee Works, in the Town and County of Nottingham, Hosiery Machinists, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

The chief object of this invention is to obviate the necessity for the attendant who has the machine in charge, having to manipulate the racking arrangement at both ends of the frame after each set of goods or parts of goods has been completed.

At one end only of the machine we fix a worm frame carrying two separate travelling slides.

One portion of the screw is cut with a left hand thread the other portion with a right hand thread, so that when the screw is revolved the travelling slides move in opposite directions.

To these travelling slides are fixed the stops controlling the various thread carriers and the brackets governing the movements of the narrowing rods.

The drawings annexed shew apparatus constructed as above described.

Figure 1 is a side elevation and Figure 2 an end view.

A is the ordinary narrowing machine shaft.

B and B¹ are narrowing rods.

C and C¹ are arms fixed to the narrowing rods.

D and D¹ stops fixed to worm-frame slides. The arms C C¹ are held up to these stops by the action of weights not shewn in the drawing—and the position of the stops so controls the position of the narrowing rods B and B¹.

E is the carrier rod driven by friction.

[*Price* 8*d.*]

F a projection from carrier rod coming in contact with sliding stops K and K¹. The stops K K¹ may be raised to put the carrier out of action when desirable.
G is a right and left hand screw controlling slides I and I¹ in worm frame.
H and H¹ are brackets carrying sliding stops K and K¹.
I and I¹ are the worm-frame slides.
J is the worm-frame.
K and K¹ are sliding stops coming in contact with projection F and controlling traverse of carrier E.
N is one of the bracket arms which carry the narrowing rods B and B¹.
M is an extra sliding stop usually fixed in machines of this character in case of another thread carrier being required.
O is a pinion on the screw G by which a step by step revolving motion may be transmitted to it in the ordinary way whenever the narrowing rods are to be shifted.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed we declare that what we claim is:—

In knitting machinery of the type generally known as "Cotton's" the employment at one end of the machine of a worm frame with two slides carrying stops for controlling the narrowing rods and thread carriers such slides being operated by right and left handed screw threads which when revolved move the travelling slides in opposite directions substantially as described.

Dated this 9th day of March 1892.

J. H. WOODWARD.
F. SHAW.

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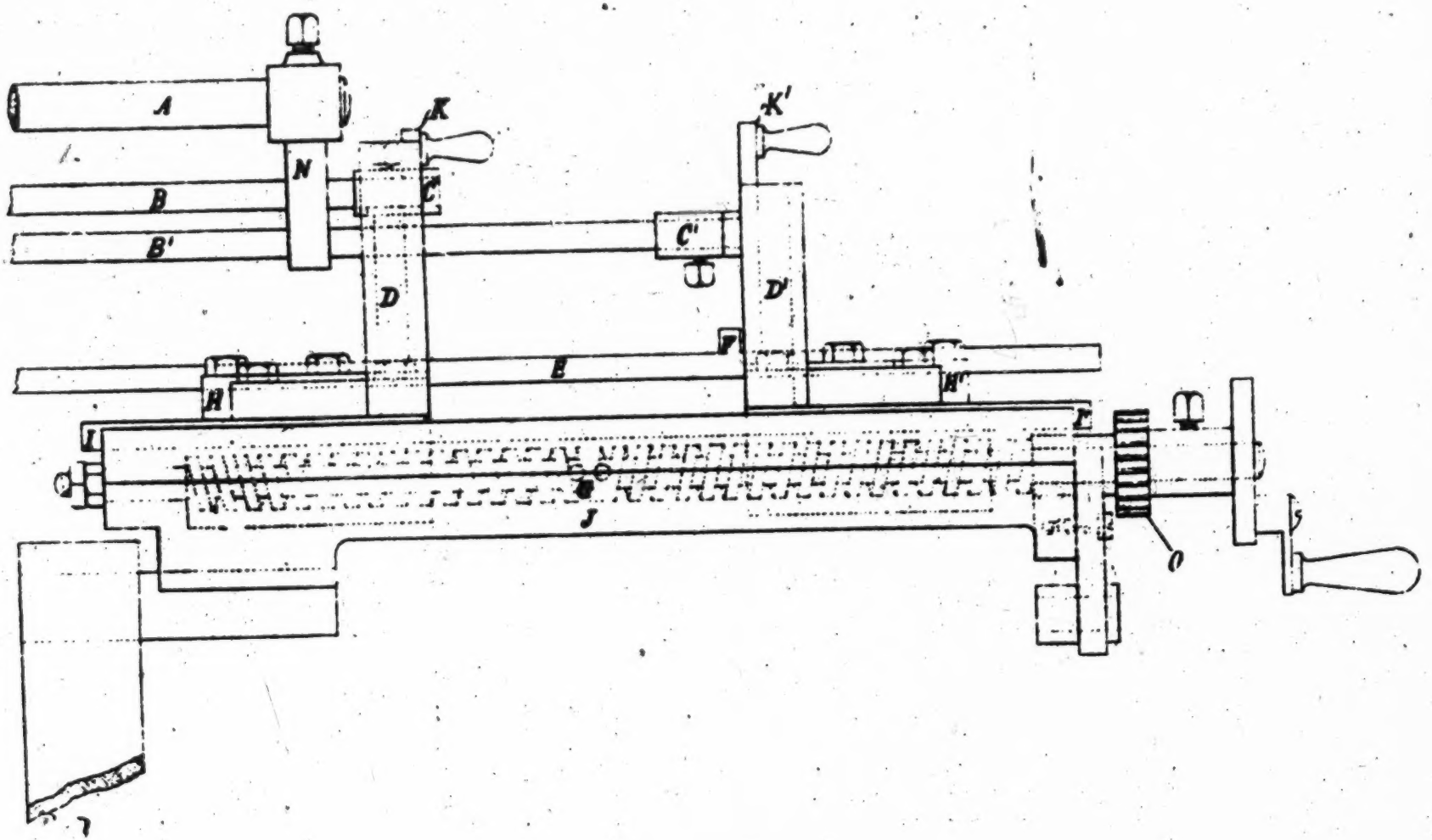
SHEET 1

FIG 1.



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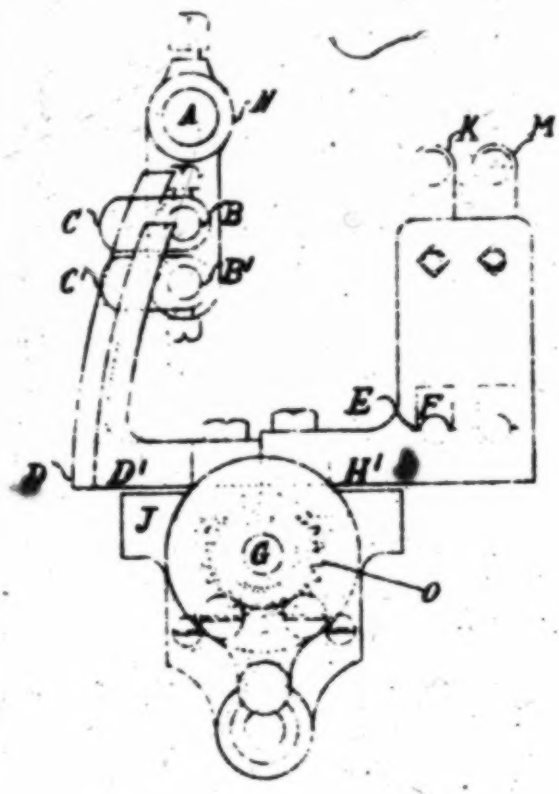
19,627 of 1891

2 SHEETS

SHEET 2

FIG. II



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London: Printed by Darling and Son Ltd
for Her Majesty's Stationery Office 1892

DEFENDANT'S EXHIBIT X

In place of this automatic arrangement of mechanism for producing the zigzag stripe, we may provide for the shogging of the bowles on or off the cams which actuate the pawls of the ratchet wheels, and thus arrest or reverse the action of the pawls, and consequently of the traversing screws of the slides, in the manner common in automatic knitting machinery, a counting wheel being provided for timing the movement of the bowles.

Dated this 25th day of September 1889.

NEWTON & SON,
Agents for the Applicants.

COMPLETE SPECIFICATION.

An Improved Mode of Manufacturing Striped Knitted Fabrics.

We, JOHN WILLIAM LAMB, Manufacturer, and JAMES NOON, Framework Knitter, both of Nottingham in the County of Nottingham, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

This invention relates to an improvement in the knitting of hosiery with longitudinal or downright stripes, for which a patent was obtained on the 8th December 1875, No. 4260, by one of us, in conjunction with Samuel Lowe.

We now propose to produce these downright stripes in a zig-zag form automatically, and for this purpose we prefer to use mechanism of the same character as that patented by one of us in connection with the said Samuel Lowe on the 7th December 1877, No. 4649.

In producing the downright stripes, the practice has been to traverse the striping thread carriers alternately two needles to the right and two needles to the left, beyond the width of stripe desired, in order to effect the junction of the stripe with the rest of the fabric.

We now propose to give to the striping thread carriers, instead of this uniform alternate extension of the traverse on opposite sides of the stripe, a continuous traverse on one side of the stripe, until the required amount of deviation is reached, and then to reverse the progressive traverse motion of the thread carriers, and continue the same on the opposite direction for the same length of travel, and so on, reversing the progressive travel as soon as the required deviation is reached. Or we may give the striping or pattern thread carriers a continuous extension of traverse on both sides of the stripe, until the required amount of deviation is reached, and then gradually contract the traverse until the normal length of traverse is regained.

To render the manner of working more clear, we will proceed to trace the progress of the knitting, course by course, and we will afterwards explain the nature of the mechanism for laying the threads in the desired manner upon the needles.

It should be remarked that the striping thread carriers in the patents above referred to, are controlled by means of stop slides, which are automatically advanced and drawn back after every course of work. It is a modification of this means which we now employ, to produce the irregular stripe, so racking in and out the pattern, and certain other stops, as to give the several thread carriers the progressive motions required.

Suppose it is desired to produce a zig-zag stripe, say, 2 needles in breadth, the striping slides will be shifted (say) to the left, to make the overlap to the left, and on the return course, 4 needles will be knitted, no overlay of the thread being made on the right hand. At the next course to the left, 4 needles are knitted, and an overlay on 2 joining needles is made, representing the progressive traverse desired.

At the return course to the right, 4 needles are knitted, but no overlay is made. At the next course, 4 needles are knitted, and an overlay of two needles is again made on the left.

In this way, the pattern stripe is shifted laterally two needles to the left, at each alternate course, until the required amount of deviation is reached. The slides will then be racked in the opposite direction, to shift the progressive motion of the thread

carriers to the right, until the requirements of the zig-zag pattern in that direction are reached. The racking of the slides will now again be reversed, and so on until the zig-zag stripe is completed.

The slides are racked in and out, as required, by a train of gear wheels, which impart an axial motion to the traversing screws of the slides, as will be hereafter explained.

In the accompanying drawings: Fig. 1 is a transverse sectional elevation of a portion of the upper part of a cotton knitting machine, shewing our new arrangement of supplementary thread carrier bars, and the mechanism for driving the same.

Fig. 2 is a partial end elevation of the same portion of the machine, illustrating the stop mechanism for the supplementary bars.

Fig. 3 is a plan view of a portion of the right hand end of the machine, shewing one division with its thread carriers and carrier bars, the pattern and narrowing slides, and the stops which they carry, and Fig. 3ª is a similar view of the slides and stops at the left hand end of the machine.

Fig. 4 is a partial front elevation of the right hand end of the machine, shewing the mechanism for automatically racking in and out the slides carrying the stops.

Fig. 5 is a partial end elevation of the same.

Fig. 6 is a front view of a central portion of the mechanism, shewing the counting wheel, and the means for governing the pattern-slide racking mechanism at opposite sides of the machine.

Fig. 7 shows inside view the draw cam which is designed to give an extra motion to the thread carriers for laying the thread on the joining needles.

Fig. 8 is a diagram illustrating the knitting of a zig-zag stripe course by course; and Fig. 9 is a similar diagram of the knitting of a modified form of stripe.

As the knitting mechanism which we employ is very similar to that shewn in the specification drawings of the patent of 1877 above referred to, and is in all respects, except the striping mechanism, like the cotton machinery in common use in the hosiery trade, we shall limit the detailed description of the drawings to the mechanism designed for producing the irregular striping, referring merely by letters to the parts common to the ordinary cotton machine.

a, Fig. 1, are the needles, a^1 the sinkers, *c* c^1 are the thread carriers. A is the slur bar, upon which slides the slur box B. C C^1 Figs. 3 and 3ª are the narrowing slides, mounted on brackets D forming part of the main framing. E, Figs. 4 & 5, is the cam shaft, from which all the motions for the working parts of the machine are derived. F. F^1 are the striping or pattern slides mounted on the brackets D. The slides C. C^1 are fitted with automatically adjusted stops, as usual, and the pattern slides F, F^1 carry stops G, G^1 which control the movements of the supplementary thread carrier bars, and also stops H. H^1, which control the inward movements of the ordinary cotton thread carrier bars. These last mentioned bars are numbered 1 and 2, and the numbers 3, 4 and 5 indicate three supplementary thread carrier bars, 3 and 4 serving to lay the thread for the stripes, and 5 to lay the thread for the intermediate portion of the fabric. The several thread carrier bars 1, 2, 3, 4 and 5, are driven by friction from the slur box B, two friction boxes on the slur box serving, as usual, to operate the bars 1 and 2, and two other friction boxes for operating the bars 3 and 4, after the manner described in a patent granted to Lamb & Lowe dated 1 November 1878, No. 4421. *b*, Fig. 3, shows one of the two bars which receive motion from the slur box, and communicate the same to the thread carrier bars 3 and 4. Standing up from these bars *b*, are standards b^1, from each of which projects a finger b^2, that enters a forked projection fitted to the bars 3. 4. These fingers are capable of being slidden up out of gear with their respective forks, to throw the carrier bars out of action. For operating the thread carrier bar 5, the slur box B is fitted with a standard b^3, which carries, at its upper end, a finger b^4, that enters a fork projecting from a friction box which embraces the thread carrier bar 5.

We have said that the stops G G^1 which control the supplementary thread carrier bars, are mounted on the pattern slides F F^1, and that the same slides also carry the stops H H^1, which control the inward movement of the ordinary cotton

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thread carrier bars. These stops, consist of brackets fitted with adjustable screws, the heads of which arrest the movements of the bars, to limit the motions of the thread carriers. The screws of the stops G G^1 serve to control the bars 3, 4, and 5, and they are so arranged that the heads of the screws for operating on the bars 3, 4 face inwards, while the heads of the screws for controlling the bar 5, face outwards.

In like manner, the heads of the screws fitted to the stops H H^1 face outwards, in order that the bar 1 may be arrested by the stop H on the right hand side of the machine, while moving with the striping thread carrier bars to the left, and the bar 2 may be arrested by the stop H^1 on the left hand side of the machine, while moving to the right with the striping thread carrier bars.

The object of this arrangement will be clearly understood when the knitting operation is explained with reference to the diagrams Figs. 8 and 9.

The slides C C^1 and F F^1 are fitted, as usual, with traversing screws, which are actuated by spur gearing. The gearing for the slides F F^1 is illustrated by dots in Fig. 5, which shews also the mechanism for imparting motion to the slide F in opposite directions, for the purpose of giving to the stops carried by that slide, a traverse motion in opposite directions. A duplication of this mechanism is employed for working the slide F^1, Fig. 3^a, at the opposite end of the machine.

I, Figs. 4 and 5, is a horizontal shaft, which turns in bearings in the framing. Upon this shaft are keyed two ratchet wheels i. i^1, their teeth being reversed, to receive driving pawls i^2 i^3 on opposite sides of these wheels, for the purpose of imparting rotary motion in opposite directions to the shaft I. Keyed to this shaft is a spur wheel i^4, which gears into the train of spur wheels connected with the traversing screw of the slide F. As, therefore, rotary motion is imparted to the shaft I in either direction, a corresponding traverse motion will be given to the slide F, and the several stops which it carries. I^1 is a segment shaped shifting shield mounted on the axle I. This shield is interposed between the ratchet wheels i i^1 and the pawls i^2, i^3, for the purpose of controlling the action of the pawls, and throwing one or other, or both, out of contact with their respective ratchet wheels. The pawls are pivotted to a rock lever I^2 fulcrummed on the frame of the machine, and carrying a bowl which rests upon a cam I^3 on the cam shaft E. The rotation, therefore, of this shaft, will cause the cam, through the lever I^2, to lift and lower the pawls, and thereby effect the rotation of the shaft I. To provide for the proper action of these pawls, or to ensure their inaction, the segment shield I^1 receives an axial motion from a tappet chain I^4 on the counting apparatus. This shield is connected by a link i^5 to an arm i^6 of a rock shaft I^5 having its bearing in the main framing. A shorter arm i^7 of this rock shaft connects, by a link i^7, with a rock lever I^6, fulcrummed on the frame of the machine, and bearing, at its front end, on the travelling tappet chain I^4. As, therefore, the tappets pass under this rock lever, the position of the segment shield will be shifted according to the requirements of the work in hand, lifting the pawl i^2 or i^3 from its ratchet wheel, and allowing the other pawl to act upon its wheel, and impart an axial motion to the shaft I, and so to the traversing screw of the slide F. Or the shield will be shifted to an intermediate position, so as to throw both pawls out of action, and thus provide for the momentary quiescence of the slides.

The tappet chain I^4 is provided with 2 sets of tappets, which have such relation to each other, as to enable the slide F^1 to move in exact correspondence with the slide F, and thus shift the position of, or contract or enlarge (as the case may be) the traverse of the supplementary carrier bars 3, 4, and 5, and the inward movement of the thread carrier bars 1, 2.

Fig. 6 shews two rock levers I^5 I^{5a}, as bearing on the tappet chain, the lever I^{5a} forming a portion of the mechanism for driving the spur gearing of the slide F^1, which mechanism is a duplication of that just described for actuating the gearing of the slide F.

For the purpose of overlaying the joining needles where required, we use, in place of the mechanism hitherto employed, a modified form of the draw cam, as shewn at K, Fig. 7, which modification consists in the extension of the cam face beyond the point ✠ (which indicates the end of the traverse of the slur box), making it

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concentric for a short distance, so as to obtain a dwell, and then giving it a slight incline to produce the overlay of the joining needles. This draw cam, as is well understood, acts through the sliding bar K¹, to impart a to and fro motion to the slur-box B, Fig. 1. The extension, therefore, of the cam surface beyond the point *, will ensure the requisite dwell for the slur box, and its subsequent further movement, to produce the above mentioned result.

Referring now to the diagram Fig. 8, the vertical lines of which represent one "division" of needles, we will proceed to explain the course of knitting to produce two zig-zag stripes in, say, the leg of a hose.

On commencing this work, the thread carriers bars are arranged as shewn on the plan views figures 3 & 3*, that is to say, all the thread carriers are brought to the right hand side of their respective portions of the division. They are now simultaneously moved to the left, to lay the thread for the first course of striped work. After this traverse, and during the knitting of the work, the striping slides F F¹ are moved further to the left, to the extent of 2 needles. The motion of the thread carriers is then reversed, to lay thread for the 2nd course. During the knitting of this course, the slides F F¹ remain stationary, and during the knitting of the third course, the slides are again moved to the left. While the 4th course is being knitted, no movement of the striping slides takes place, and this order of working may be continued so long as the deviation of the stripe to the left hand is required.

Suppose, for example, the knitting is carried on up to the 11th course before changing the direction of the stripe, and the slides F F¹ are moved to the left during the knitting of that course, then, to reverse the direction of the inclined stripe during the knitting of the succeeding course (the 12th), the striping slides will be moved to the right hand. At the next course (the 13th), the slides will remain stationary, and will be again moved to the right hand at the 14th course, and so on at every other course, as long as the deviation to the right is required to continue.

It will be understood that the traverse of the intermediate and outer thread carriers up to the edges of the stripes being governed by stops carried by the slides F F¹, will of necessity have their traverse lengthened or shortened in such a way as to lay thread for the joining needles of the stripes at both edges of the same. Thus, the joining needles will be alternately supplied with a thread from the intermediate or outer carrier, and a thread from the striping carrier, and the needles in the "division" will be supplied with one thread only at every traverse of the thread carriers for a new course of work.

From the foregoing explanation, it will be understood that the progress of the stripe may be continued to any desired length through the work. If, however, it is desired to stop the striping, and to carry on plain knitting beyond the stripe, the thread carrier bars not required for further use, are to be locked out in the usual way.

Diagram Fig. 9 shews a mode of working to produce a variation in the form of the stripe, giving it a gradual increase in width from both sides of the stripe, until the maximum width is attained, & then a gradual decrease in width until the normal width of the stripe is reached. By this course of working, varieties of patterns within circumscribed limits may be produced, and thus a distinctive character may be given to the work.

The vertical lines in the diagram Fig. 9 represent the needles of one "division," and the horizontal lines the courses of work, the normal width of the stripe being equal to 2 needles, with a lap on two joining needles, but on opposite sides at each course. To produce the work indicated in Fig. 9, the machine has its striping slides arranged to provide for a traverse equal to four needles for the striping thread carrier bars, and both slides are simultaneously moved at the knitting two needles to the right, when the traverse of the carriers is to the right, and two needles to the left, when the traverse is to the left, as long as the downright stripe is required.

A diamond or lozenge shaped extension of a two needle stripe shewn in the diagram is formed by 7 courses in the following manner :—

The right and left hand slides are simultaneously moved outwards to the extent of 2 needles, and thus a traverse of the striping thread carriers is correspondingly

extended, so that at the next course, say, to the right, 8 needles may be overlaid with thread instead of 4. When this course (the 1st of the diamond or lozenge shaped figure) is knitted, both slides will be again moved 2 needles in opposite directions, as before, so that, for the second course of the figure, thread will be laid to the left over 12 needles. When this course is being knitted, the slides will be again simultaneously moved out, the further to increase the width of the figure, and, for the 3rd course (to the right), 16 needles will be supplied with thread. The limit required by the pattern being now reached, bothe slides will, during the knitting of this course, be racked in the same direction two needles to the left. The right hand slide will carry in the carriers which it has served to stop. On the knitting of this, the 4th course, both slides will be moved in, the left hand slide, say, carrying with it inwards the carrier bars which it has served to stop the extent of two needles, so that at the next course, 12 needles will be supplied with thread. While this course is being knitted, both slides will be again moved inwards, the right hand slide carrying onwards with it the carrier bars it has stopped, and, at the succeeding course, 8 needles will be supplied with thread.

While knitting this course, the slides will be again simultaneously moved inwards, and the left hand slide will carry in the carrier bars, so that at the 7th course, four needles only will be supplied with thread, to resume the knitting of the normal width of stripe. At the knitting of this course, the right hand slide will be moved out, to allow thread to be laid upon the joining needles, the left hand slide at the same time moving inwards. The simultaneous moving of the slides alternately to the right and left, at the time of the knitting of each course, can now be continued as long as a straight stripe of two needles in width with the joining needles is desired to be knitted.

The traverse of the thread carriers for laying the thread for the fabric intermediate of the colored stripe or figure pattern, and also of the selvage thread carriers on their inward movement, being governed by stops on the striping slides, as above explained, will be limited as the colored stripe or figure increases in width, and lengthened as the stripe or figure decreases in width. The outer traverse of the selvage carrier bars, it will be understood, is governed, as usual, by the stops of the narrowing slides.

Having now particularly described & ascertained the nature of our said invention & in what manner the same is to be performed, we declare that what we claim is:—

The mode above described of producing irregular striping in knitted fabrics, such mode consisting in controlling the thread carriers by the use of the pattern slides, to which a progressive motion is imparted either in the same or in opposite directions, for the purpose of shifting the field of traverse of the carriers which such slides control, or of enlarging and contracting the length of traverse of the thread carriers, as & for the purpose set forth.

Dated this 25th day of June 1890.

NEWTON & SON,
Agents for the Applicants.

London: Printed for Her Majesty's Stationery Office, by Darling & Son, Ltd.—1890.

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A.D. 1883 Sep. 25. N° 15,129

LAMB & *another's* COMPLETE SPECIFICATION.

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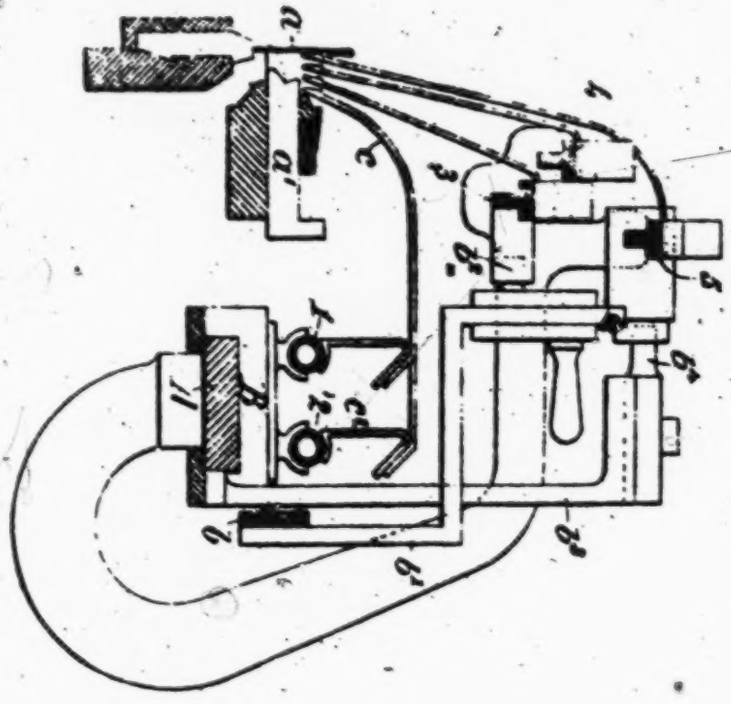

Fig. 1.

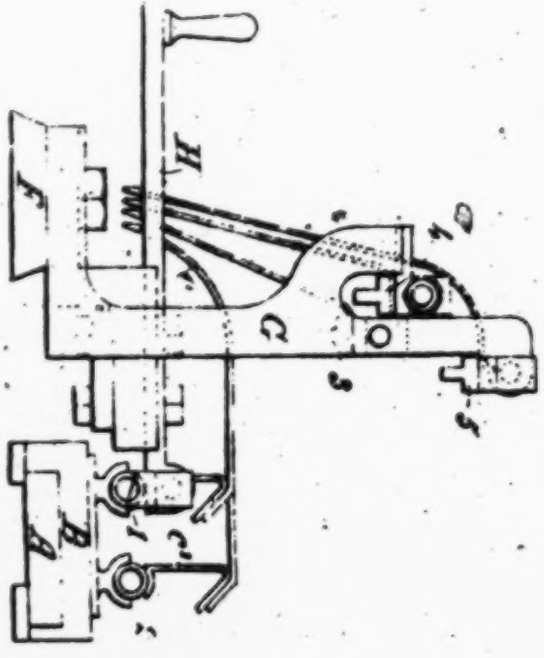

Fig. 2.

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Fig. 3a

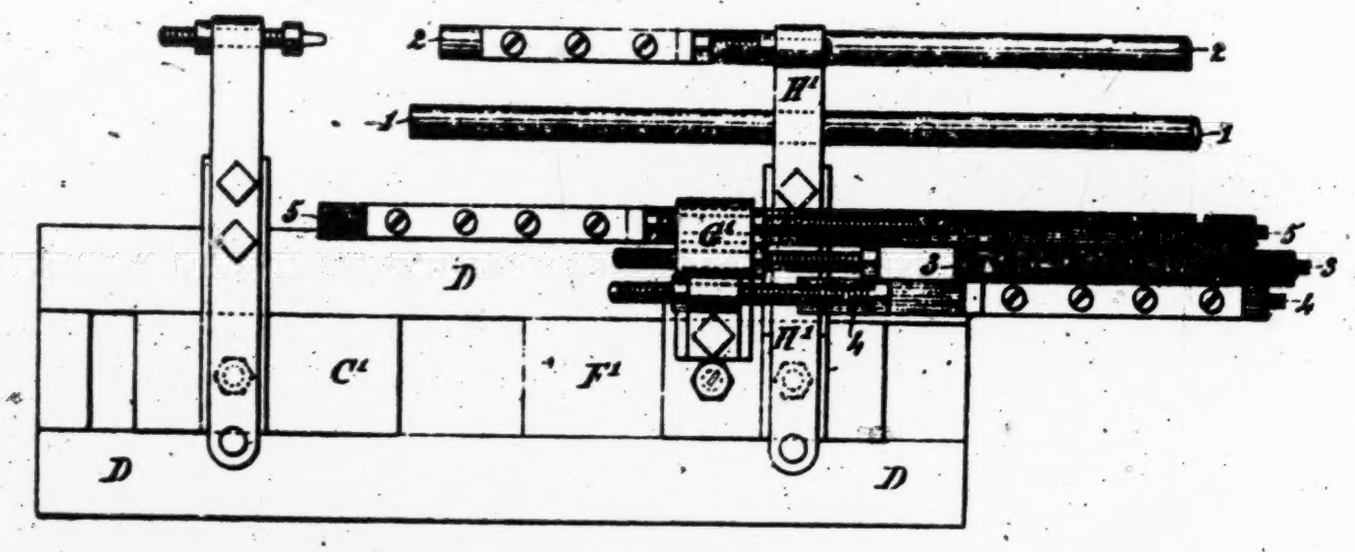
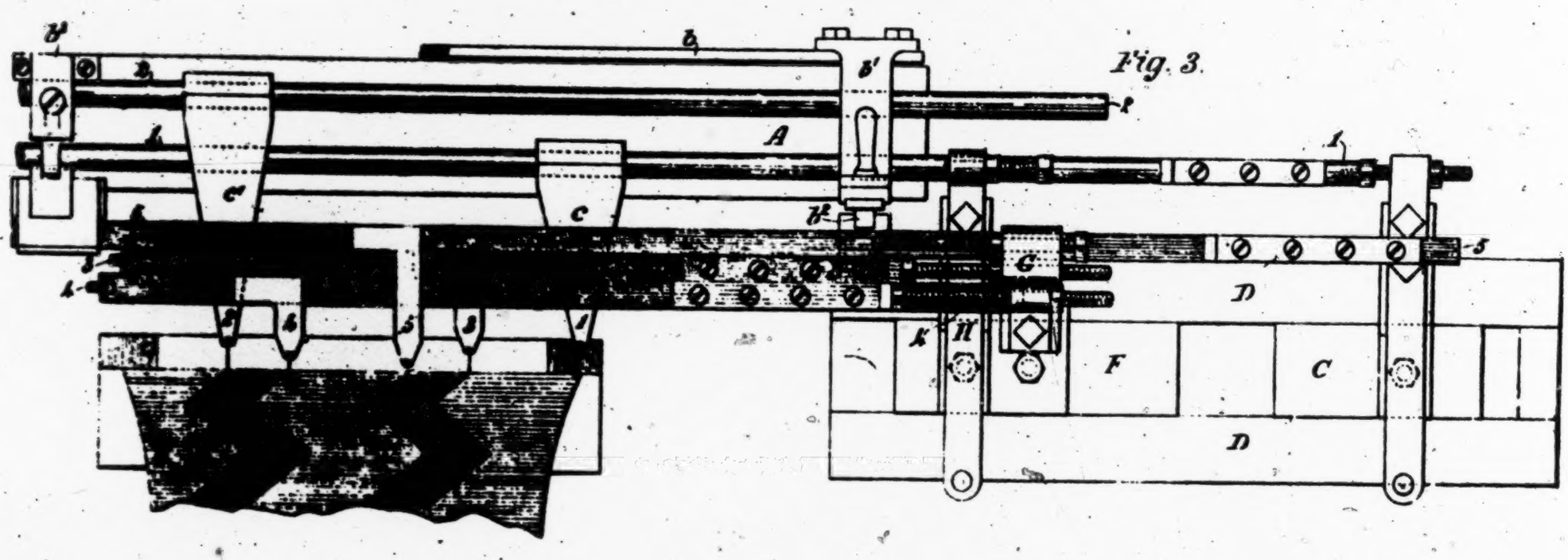


Fig. 3.



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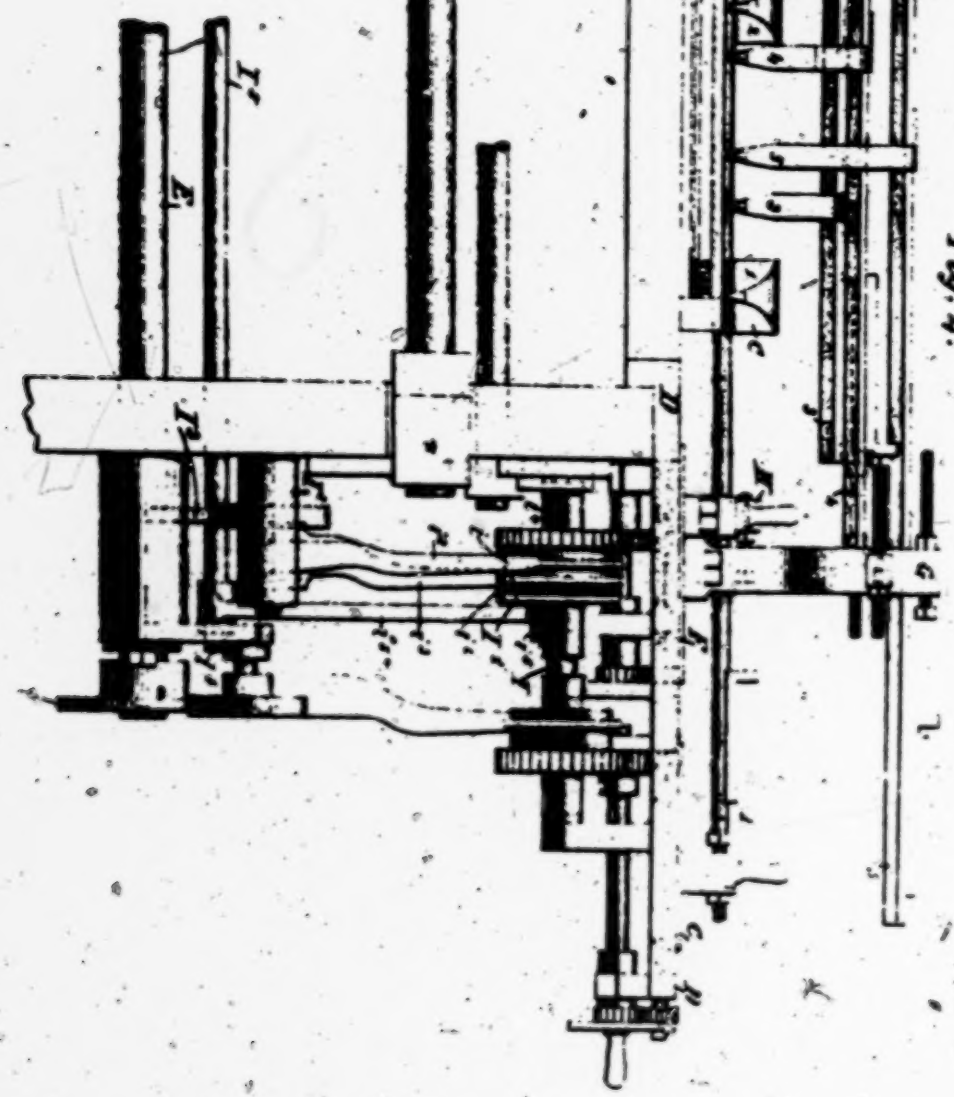

Fig. 6.

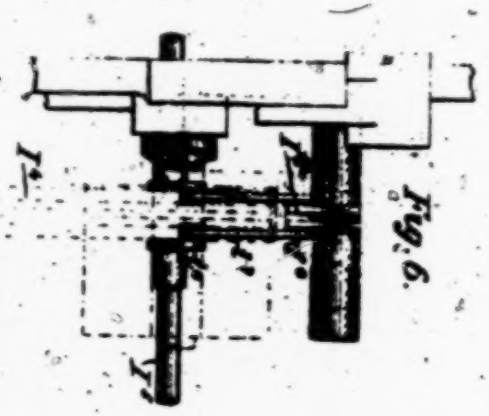

Fig. 4.

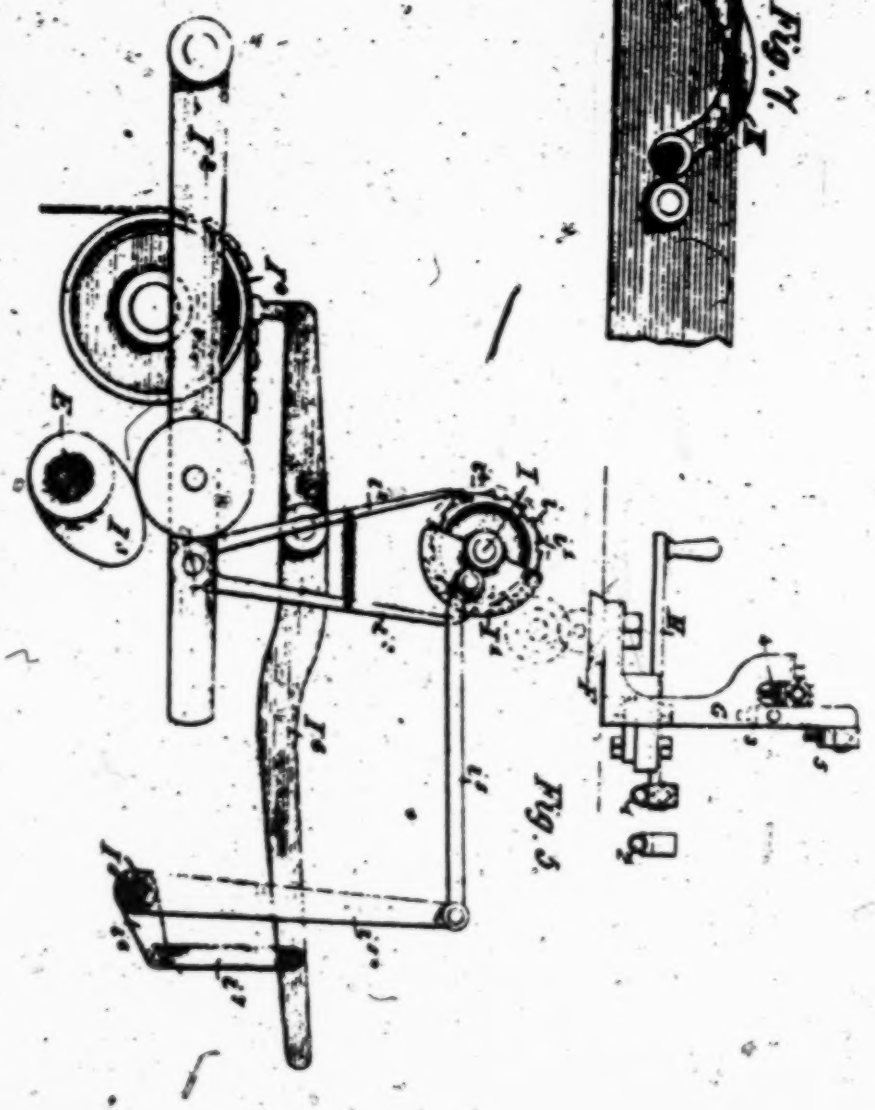

Fig. 5.

Fig. 7.

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Fig. 8.

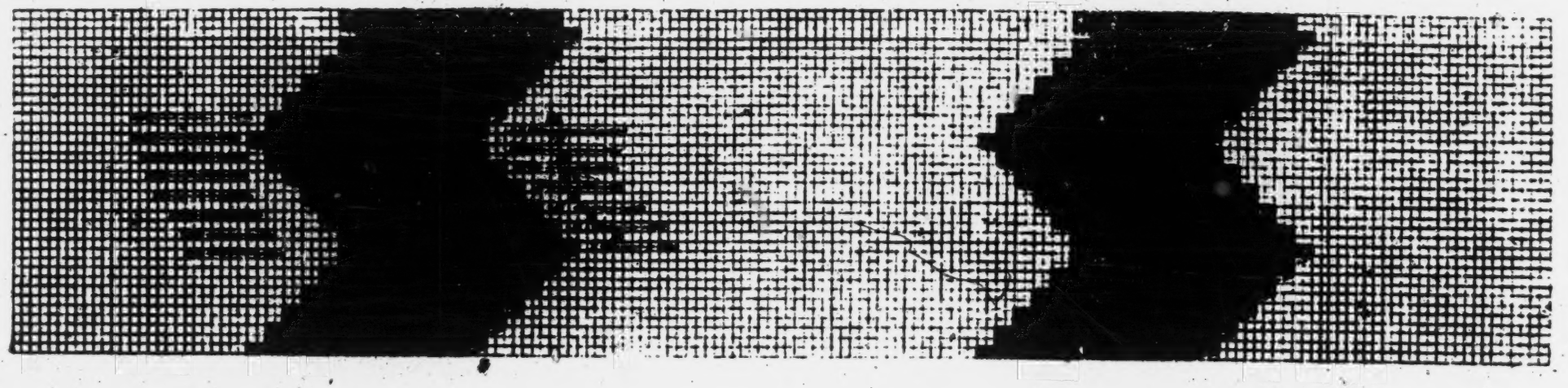
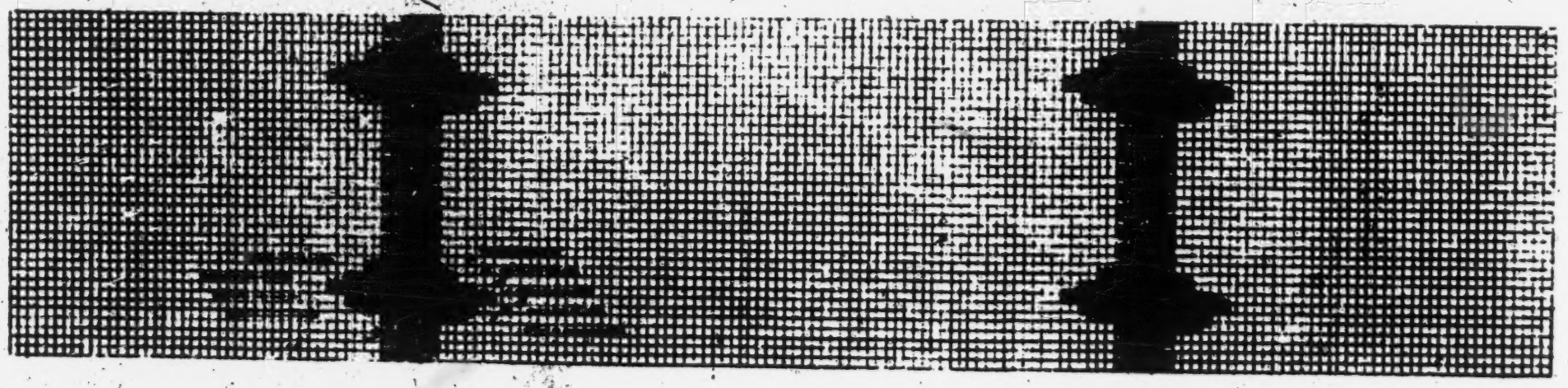


Fig. 9.



[This Drawing is a reproduction of the Original on a reduced scale.]

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DEFENDANT'S EXHIBIT Y 824

N° 1967.—A.D. 1890.

Clarinbourn's Improvements in Knitting Machines

COMPLETE SPECIFICATION.

Improvements in Knitting Machines.

I, JOSEPH AUGUSTUS CLARINGBURN, Hosiery Machinist, Liverpool Street, Nottingham, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

My invention relates to straight bar knitting machines known as Cotton's Patent, and is for improvements on the invention described in Specification No. 18,461 A.D. 1888, in which a wide set of fashioning points are capable of being attatched and detatched to and from the ordinary fashioning points, the wide sets being turned up when not required, but owing to the exactitude required when brought into action considerable time is wasted in adjusting the same. When the wide points are working fashionings may be made at some distance from the selvage of the fabric and when they are turned up fashionings may be made by the narrow points on the selvage only. In the Specification referred to there are two screws used and the nut of the is prevented from turning by sliding in the nut of the lower screw and consequently the breadth of the fashioning is limited.

Now the object of my invention is to enable two sets of fashionings to be made, one on the selvage and one at some distance from the same, the two sets of fashionings being made either upon the same row of loops or upon different rows as may be required, and in order to carry out my invention, two separate sets of fashioning mechanism are required, and in applying these it is necessary to have two separate sets of fashioning cams in addition to the ordinary knitting cams, and to be able to bring any one of the sets of cams into action the cam shaft must be capable of being moved from any one set of cams to any other set.

The needles, thread carriers, and the other ordinary parts of the machine are the same as usual and the motions of these parts are well understood, I have therefore not described or shown any of these parts, except where necessary to explain my invention and in order that the same may be better understood I have attatched five sheets of drawings which show the fashioning apparatus at one end of the machine, that at the other end being a duplicate and the same parts in all the drawings are referred to by the same letter or figure.

Fig. 1 is an end elevation of the screws used for actuating the fashioning points, and the mechanism for working the same.

Fig. 2 is a front elevation of the parts shown in Fig. 1.

Fig. 3 is a detail showing the connection between the fashioning point bars and the screw boxes.

Fig. 4 is a front elevation of one breadth of needles showing the two sets of fashioning points and the bars carrying the same.

Fig. 5 is an end elevation of the fashioning points at the left hand side of each division of needles, showing the same attatched to the lower fashioning point bars.

Fig. 6 shows the points at the right hand side of the division of needles the same being connected to the upper fashioning point bars.

Fig. 7 represents the arrangement for carrying the two sets of fashioning bars which are both shown in their highest position.

Fig. 8 represents the same arrangement when one set of bars have been lowered.

Fig. 9 is a section of the cam shaft and the parts used for shogging the same.

Fig. 10 is a front elevation of Fig. 9.

Fig. 11 is a plan of the same.

Figs. 12 & 13 details of cams.

Referring to Figs. 1 to 8 A represents the ordinary fashioning screw, mounted in bearings carried by a bar B which is fixed to the machine frame, and on the screw is the screw-box C to which a bracket *a* is attatched ; to prevent the nut turning the bracket slides upon a fixed rod *b*, the nut also carries a bar *c* for

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actuating the fashioning point bar D carrying the narrow points F, the other set of narrow points G being attatched to the bar E and actuated from the other end of the machine. Fixed on the end of the screw A there are two ratchet wheels *d* & *e* which are actuated by pauls *g* & *f* carried by a lever G¹ pivoted on any suitable support and actuated by a cam H on the cam shaft J. This cam H is made double the width of the other cams so that when the cam shaft is shogged one step the narrow points F & G are moved endways but when the shaft is shogged two steps the narrow points are moved either before or after the wider ones.

The screw A is provided with a handle *h* a catch wheel *j* and a spring *k* so that the screw can be turned by hand, and held in position. There is also a cam K turning on an axle *l* and is used for holding either of the levers *f* or *g* out of action: these are connected by a spring *m* so that when one is held out of action the spring pulls the other into action.

The brackets carrying the screw A are produced upwards & form bearings for a screw L provided with a nut M which is prevented from turning by causing it to slide between two fixed bars *n*, the nut is also provided with a projecting piece *o* which actuates the bar N carrying the wide points O at the right hand side of each division of needles *p*, the wide points P at the left hand side of each division of needles being carried by a bar Q which is actuated by a similar arrangement at the other end of the machine. Upon the screw A and forming a bearing for the same is a bush which projects each side of the end bracket *q* and upon it there are fixed four ratchet wheels *r*, *s*, *t*, & *u*, also a spur wheel *v* which drives another spur wheel *w* fixed upon the top screw L, so that any movement given to any of the ratchet wheels *r*, *s*, *t*, & *u* is transmitted to the screw L and the fashioning points connected to the same. The wheels *v* & *w* may gear into each other and a screw used with a thread opposite hand to that of the screw A, or an intermediate wheel may be used between the wheels *v* & *w*, both screws being then the same hand, or the ratchet wheels *r*, *s*, *t*, & *u*, may be fixed on the screw L and actuated direct. The screw L is provided with a handle *x*, catch wheel *y* and spring *z* for turning it by hand and holding it in position.

The ratchet wheels *r* & *s* are provided with pauls R & S carried by a lever V suitably pivoted on a fixed spindle and actuated by a cam W, while the ratchet wheels *t* & *u* are provided with pauls T & U carried by a lever X which is actuated by a cam Y, the lever being pivoted on the same spindle as the lever V. The pauls R & S are thrown in and out of action by the same cam K as operates upon the pauls *f* & *g* but the pauls T & U are automatically thrown in and out of action by a cam Z which has an odd number of faces and is turned round half a face at each movement by a ratchet wheel A¹ connected to it by a collar *a*¹ and actuated by a paul B¹ carried by a lever C¹ which is operated upon by a cam D¹.

According to the arrangement of cams, ratchet wheels and pauls just described, I am enabled when the shaft J is shogged one step, to throw the cam H into action and then make fashionings on the selvage of the fabric by the narrow points only, and when the shaft is shogged to the second step, the cam H will move in or out the narrow points and the cam W the wide points, the direction in which both sets of points are moved depending upon the position of the cam K. The cam Y is also acting and causes either the paul T or U to act upon the screw L and give an additional movement to the wide points which may be in the same direction as the movement given them by the cam W or in the opposite direction.

The bars N & Q Figs. 7 & 8 for the wide sets of points are carried in brackets *c*¹ capable of turning on a shaft *d*¹ carried in bearings on the arms *e*¹ fixed upon a rocking shaft *f*¹, and the bars D & E for the narrow sets of points are carried in brackets *g*¹ by a shaft H¹ & J¹ the arrangement being similar to that for the bars N & Q, the two sets being so arranged that either can be brought into action without interferring with the other. The mechanism for raising and lowering both sets is of the usual description and both sets of points are fitted with filling-up points *k*¹ which are worked by arms *l*¹ and shafts *m*¹ in the usual manner.

The mechanism for shogging the cam shaft is shown in Figs. 9, 10 & 11. The

cam shaft has fixed upon it a shogging cam A^2 made with three cam faces a^2 b^2 & c^2 and parallel with the cam shaft I place a short shaft B^2 which carries a main shogging lever C^2 provided with a cam truck d^2 which rides upon one of the three cam faces a^2 b^2 or c^2 and when on the first face a^2 the shaft is held from end movement by the truck d^2 riding between the face a^2 and a face e^2 of a counter cam D^2. When the truck d^2 is on the face b^2 the shaft is held from end movement by a truck g^2 on a second shogging lever F^2 running upon a face f^2 on a second counter cam E^2 which is fixed upon the shaft J. When the truck g^2 is on the face c^2 the shaft is held from end movement by the base of the cam A^2 coming into contact with a fixed part of the machine, or a collar upon the shaft may be brought against any convenient fixed part.

In order to move the truck d^2 from one face of the cam A^2 to either of the other faces, the shaft B^2 is rocked in its bearings, and for this purpose it has fixed upon it two levers G^2 & H^2 which are acted upon by cams J^2 & K^2 respectively these being carried on a shaft L^2 and rotated by ratchet wheels M^2 & N^2 from pauls carried by any convenient moving part of the machine. The cam J^2 consists of two plates k^2 & f^2 each having two projections l^2 upon them, the plates being so connected that the projections on them may be brought and act as two projections or as a plate with four projections, the relative position being varied as required. The cam J^2 is used when fashioning with the narrow points only is required, its projections l^2 being such that when they act upon the lever G^2 the shaft B^2 is rocked to bring the truck d^2 onto the face b^2. The cam K^2 likewise consists of two plates l^2 & m^2, the former having projections n^2 upon it and the latter smaller projections o^2, while the two plates are arranged so that the projections o^2 can be brought in a line with the projections n^2 and being the smaller are thereby rendered inoperative; when the plates l^2 & m^2 are in this position the projections n^2 act upon the lever H^2 thereby rocking the shaft B^2 so that the truck d^2 is moved on to the face c^2, this taking place when fashioning with the wide points is required, but when fashionings with both sets of points are required then the plates l^2 & m^2 are moved until they form a cam with four projections which act alternately on the lever H^2 & move the truck d^2 from the face a^2 to the face b^2 and then from the face a^2 to the face c^2 these movements taking place alternately. Each set of cams are worked independently of the other, the set J^2 revolving on the shaft and the set K^2 with it, while the clawkers used for actuating the ratchet wheels M^2 & N^2 can be thrown out of action as required. There is also a suitable brake applied to each set of cams to prevent over-running and each set is provided with several ratchet wheels so that the number of courses between each fashioning may be regulated.

There is also another lever O^2 on the shaft B^2 carrying a truck s^2 running upon one of the three cams P^2 P^2 or P^2 and it is used to prevent the lever C^2 moving from one face to another with a jerk, the cams P^2 P^2 & P^2 being level at one point in the same line as the other cams, so that the shaft may be shogged endways.

In the foregoing description of parts and the mechanism for actuating the same, I have described the means employed for moving the parts in one direction, the return-motion being obtained by springs, or weights, or the weight of the parts themselves as is usual in this class of machinery.

Having now described the various parts and their separate movements, I will now describe the action of the machine when at work. A piece of fabric is first run on the needles, and a number of courses of plain knitting worked; I will then suppose that narrowing on the selvages are required, I therefore throw into action a paul to actuate the ratchet wheels M^2, the particular wheel depending upon the number of courses between each narrowing, this wheel then turns the cam J^2 which may be adjusted to give two narrowings for each revolution of the same, or four narrowings for each revolution.

The cam J^2 acting to raise the truck d^2 until it rides upon the face b^2 and thus shog the shaft J, bringing into action the cam H which operates the lever G^1 and turns the screw A through the paul g and ratchet wheel d, the cam K being turned

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so that this paul shall fall into gear, as shown in Fig. 1. If widenings are required the cam K is turned so that the paul *f* comes into gear with the ratchet wheel *e*: the filling-up points are also connected to their operating cam and come into action, the remaining parts of the mechanism for widening being the same as those described for narrowing. I will then suppose that the requisite fashionings on the selvage only, have been completed, the paul turning the ratchet wheels M^2 is then thrown out of action and plain knitting may be produced, and I will now suppose that fashionings are required at some distance from the selvage, I therefore throw into action a paul for turning one of the ratchet wheels N^2, and the cam K^2 the plates of which are set so that the projections on the plate n^2 are behind those on the plate l^2 and as these come round they act upon the lever H^2 and move the truck d^2 on to the face c^2 and thus shog the cam shaft J, bringing into action the cams H, W, Y & D^1 then if the cam K is turned to throw the pauls *f* & *g*, R & S out of action the pauls T & U turn the screw L first in one direction and then in the other, thus moving the wide sets of points in and out alternately.

Then if the cam K is turned so as to throw the paul R into action it moves the wide points inwards and the cam Y acts to move the screw L so that the wide points are either carried further in or they are returned; suppose the paul R moves the screw L so that the wide points are carried in one needle and a narrowing made, the paul U then acts and moves the wide points inwards for a distance of several needles, at the same time as they are being lowered; they then take the loops partially rise and the paul R then moves them in one or more needles and the loops are replaced upon the needles; at the next narrowing the paul T acts and moves the wide points out as many needles as the paul U had previously moved them in, they receive the loops and are then moved one more needle in by the paul R: these motions being repeated cause two rows of narrowings to be made.

When widening with these points the filling up points are brought into action, and the cam K turned to throw out the paul R and in the paul S. The narrow points are also being brought inwards but do not make narrowings because the cam bringing down the points is not in action. When fashionings are required both at the selvage and at a distance from it, the plates l^2 & n^2 of the cam K^2 are turned so that the projections o^2 are brought from behind the projections n^2 and act alternately upon the lever H^2 moving the truck d^2 from the face a^2 to b^2 and back again, & then from the face a^2 to c^2 and back again, thus alternately throwing into and out of action the cam H and the cams H, W, Y & D^1 which act upon the various pauls in the manner already described.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. The combination of two sets of fashioning mechanisms, arranged and capable of being operated substantially as shown and described.
2. The use of a third set of cams.
3. The construction and arrangement of the cams J^2 & K^2 and levers C^2, F^2, G^2 & H^2 for actuating the shaft B^2 and truck d^2 substantially as and for the purpose specified.
4. The general arrangement of the mechanism for shogging the cam shaft, substantially as shown and described in the accompanying drawings and Specification.

Dated this 24th day of December 1890.

J. A. CLARINGBURN.

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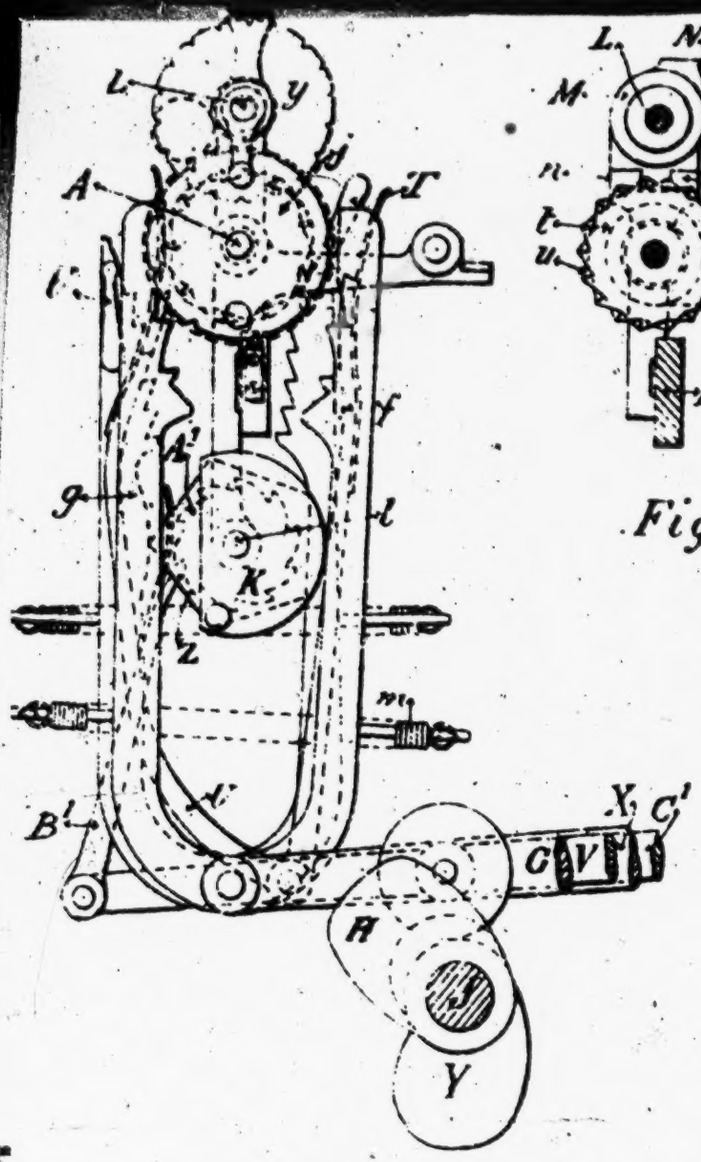

Fig. 1

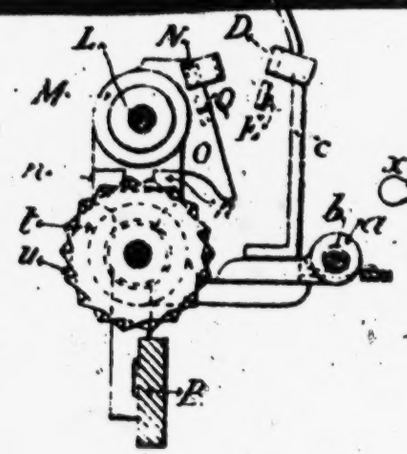

Fig. 3

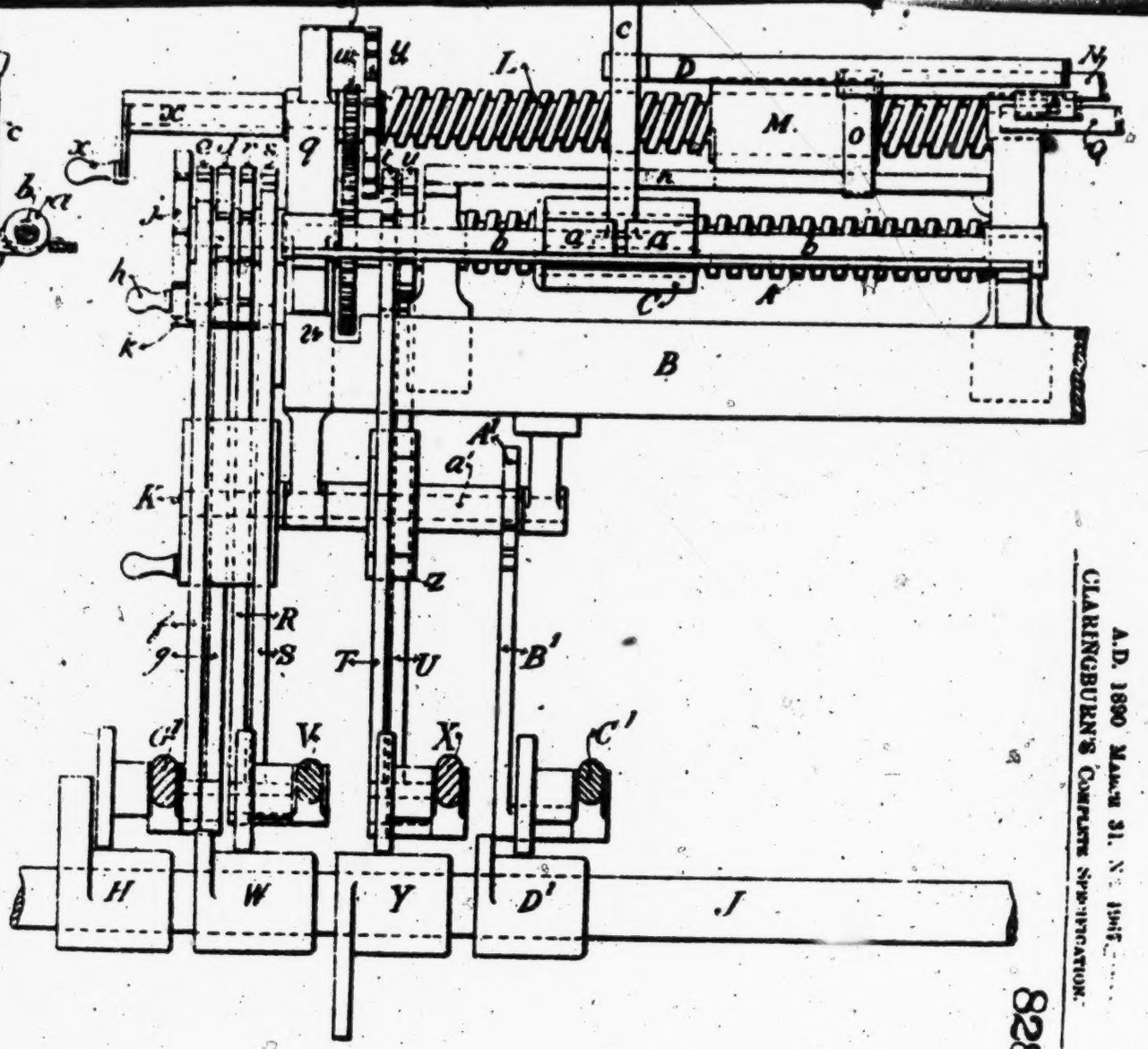

Fig. 2.

A.D. 1890 March 31. No. 1961.
CLARINGBURN'S Complete Specification.

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No. 829, A.D. 1890

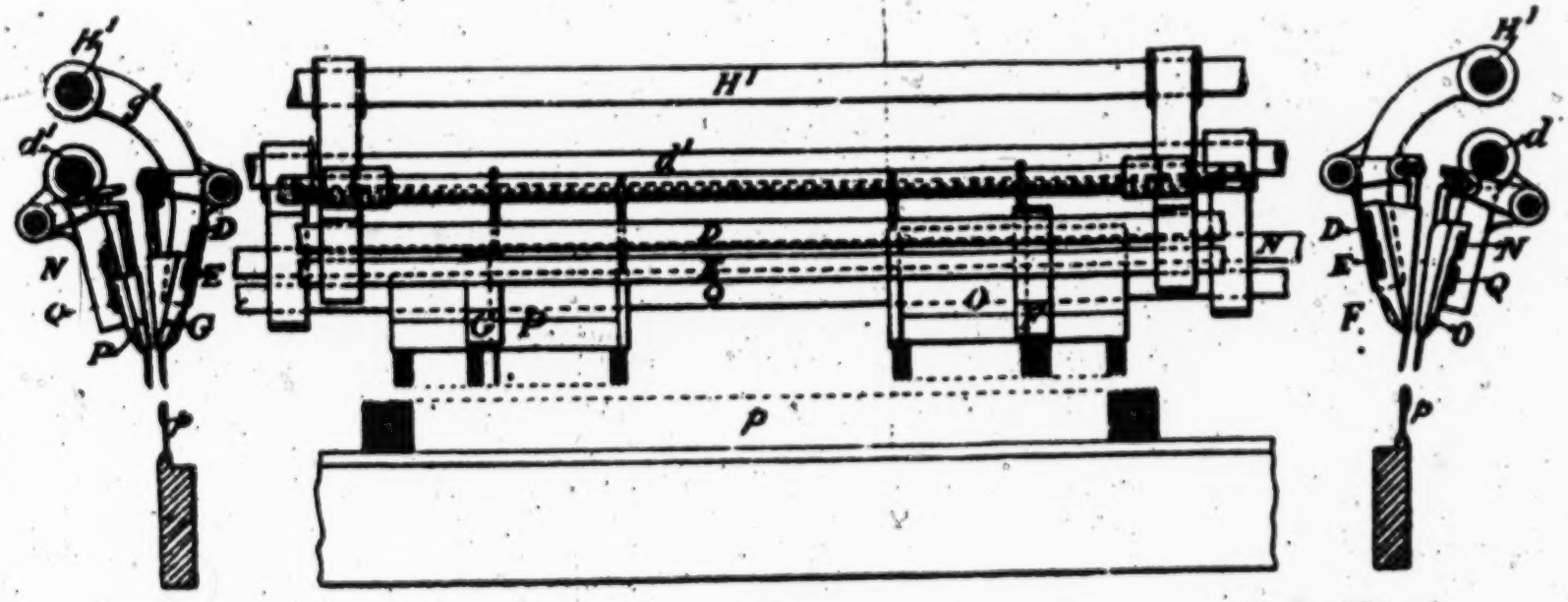

Fig. 5

Fig. 4

Fig. 6

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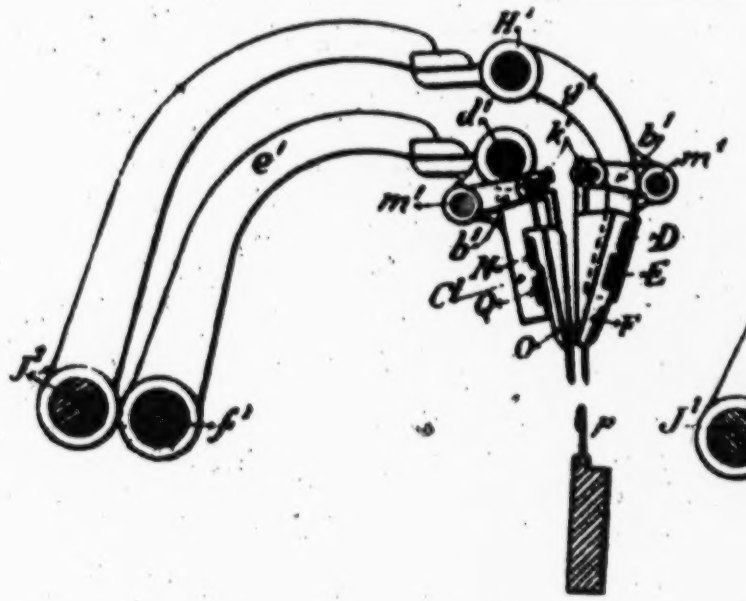

Fig. 7

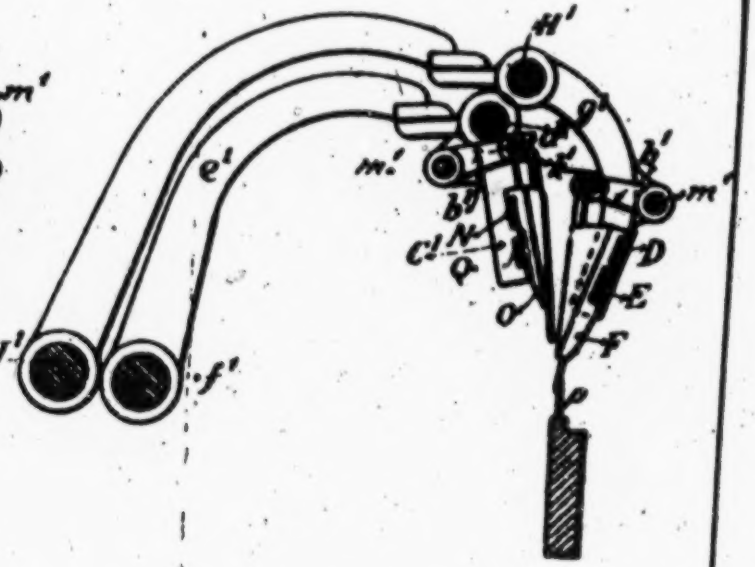

Fig. 8

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CLARKSBURN'S COMPLETE SPECIFICATION.

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Fig. 12

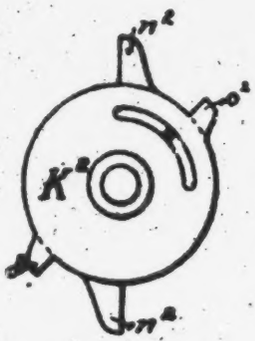

Fig. 11

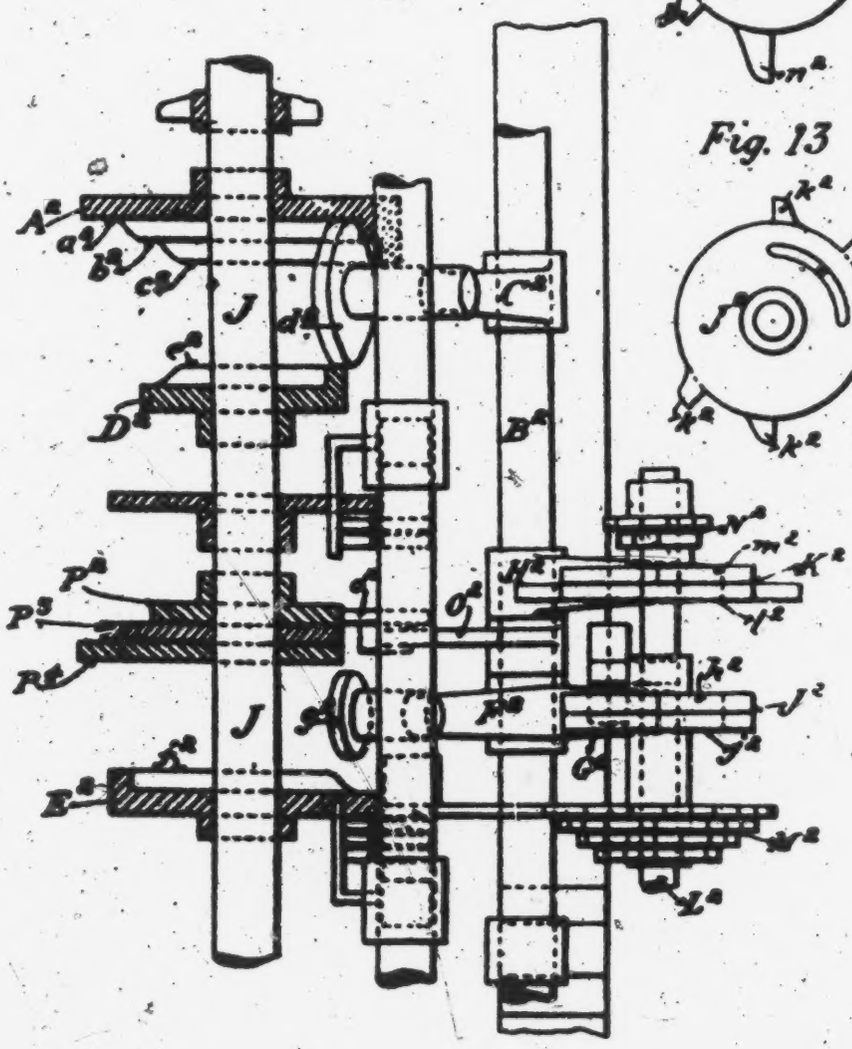

Fig. 13

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15 SHEETS
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Fig. 9.

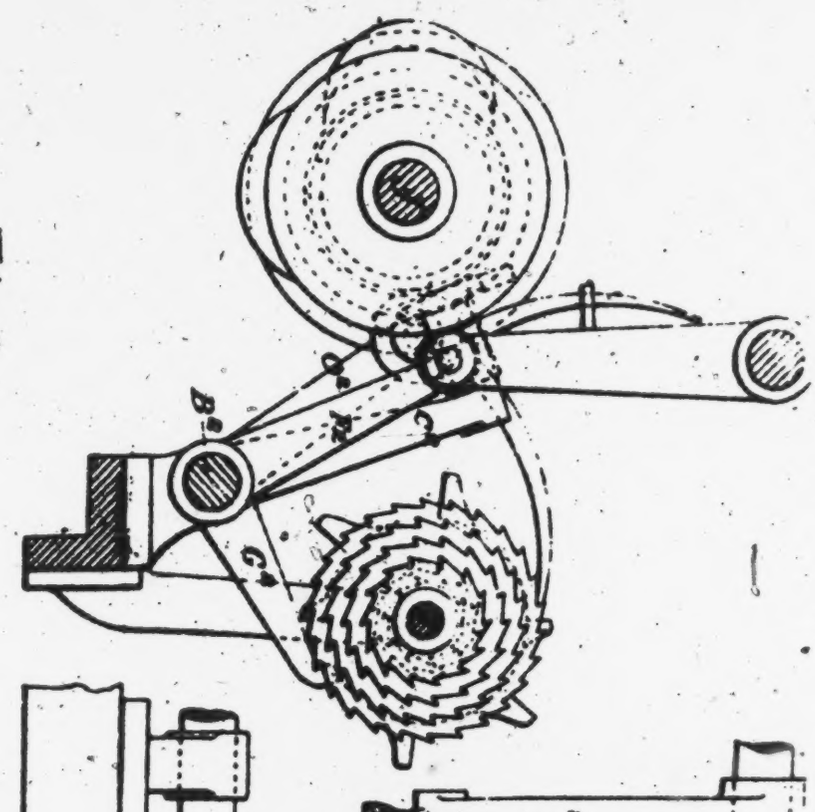
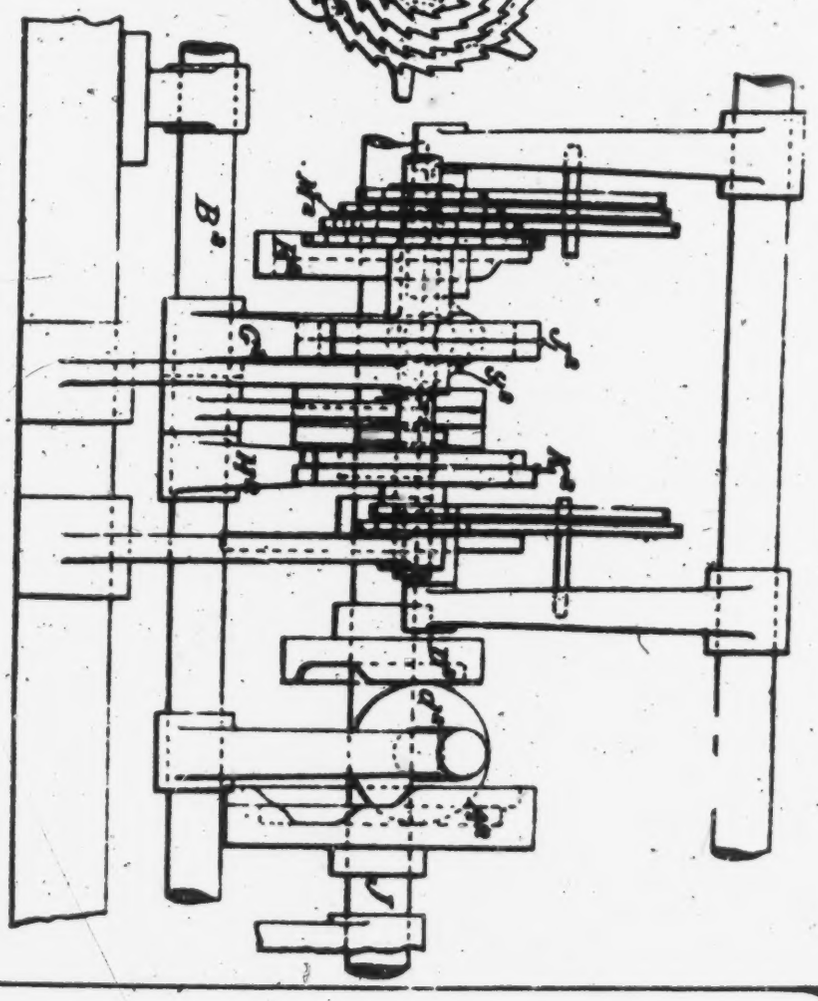


Fig. 10



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DEFENDANT'S EXHIBIT Z

LAMB & NOON

BRITISH PATENT No 15,129. SEPTEMBER 25,1889

(1)

Fig. 3a

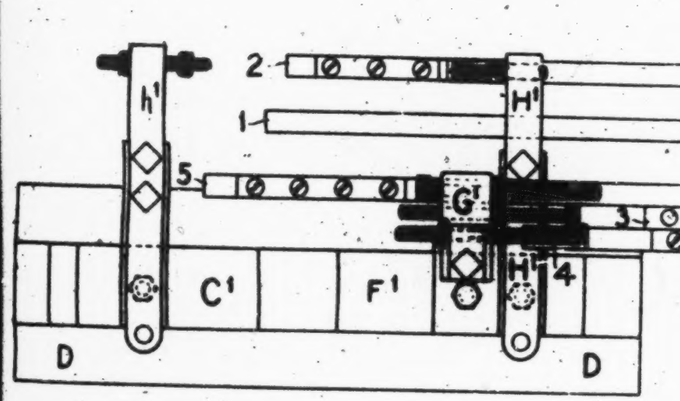
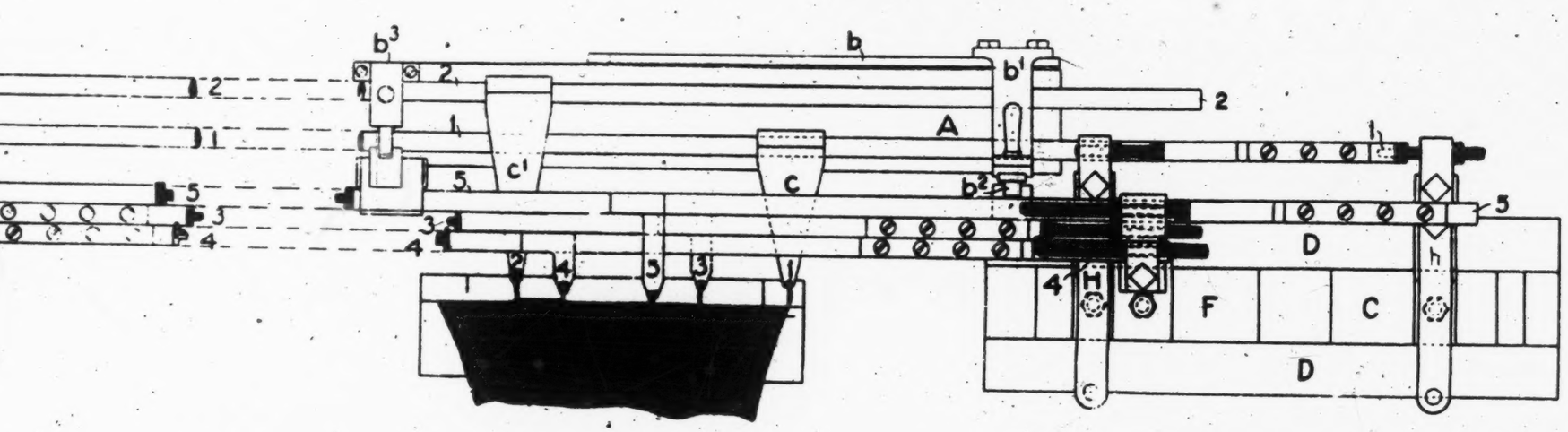


Fig. 3



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LAMB & NOON

BRITISH PATENT No 15,129, SEPTEMBER 25, 1889

Fig. 4

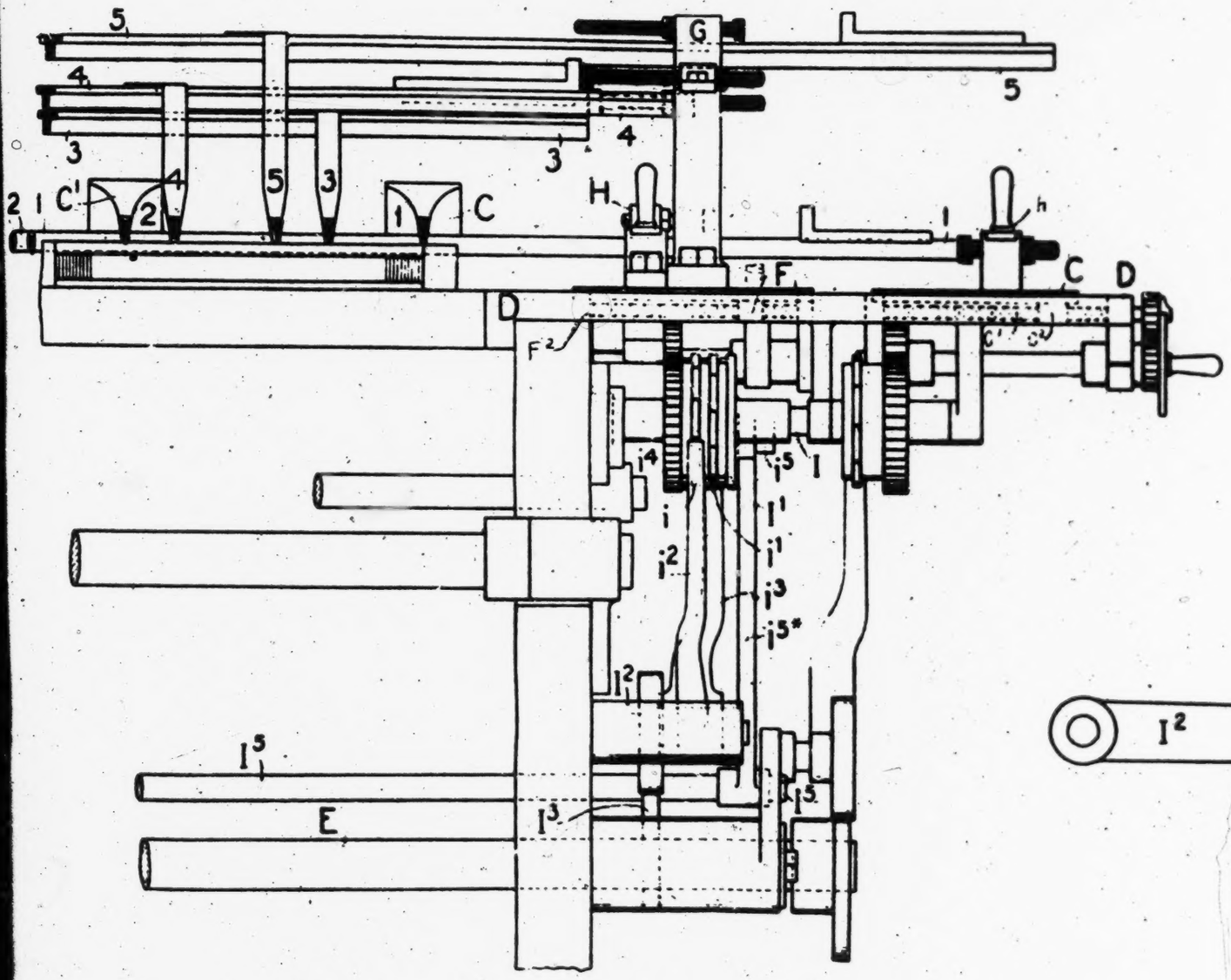
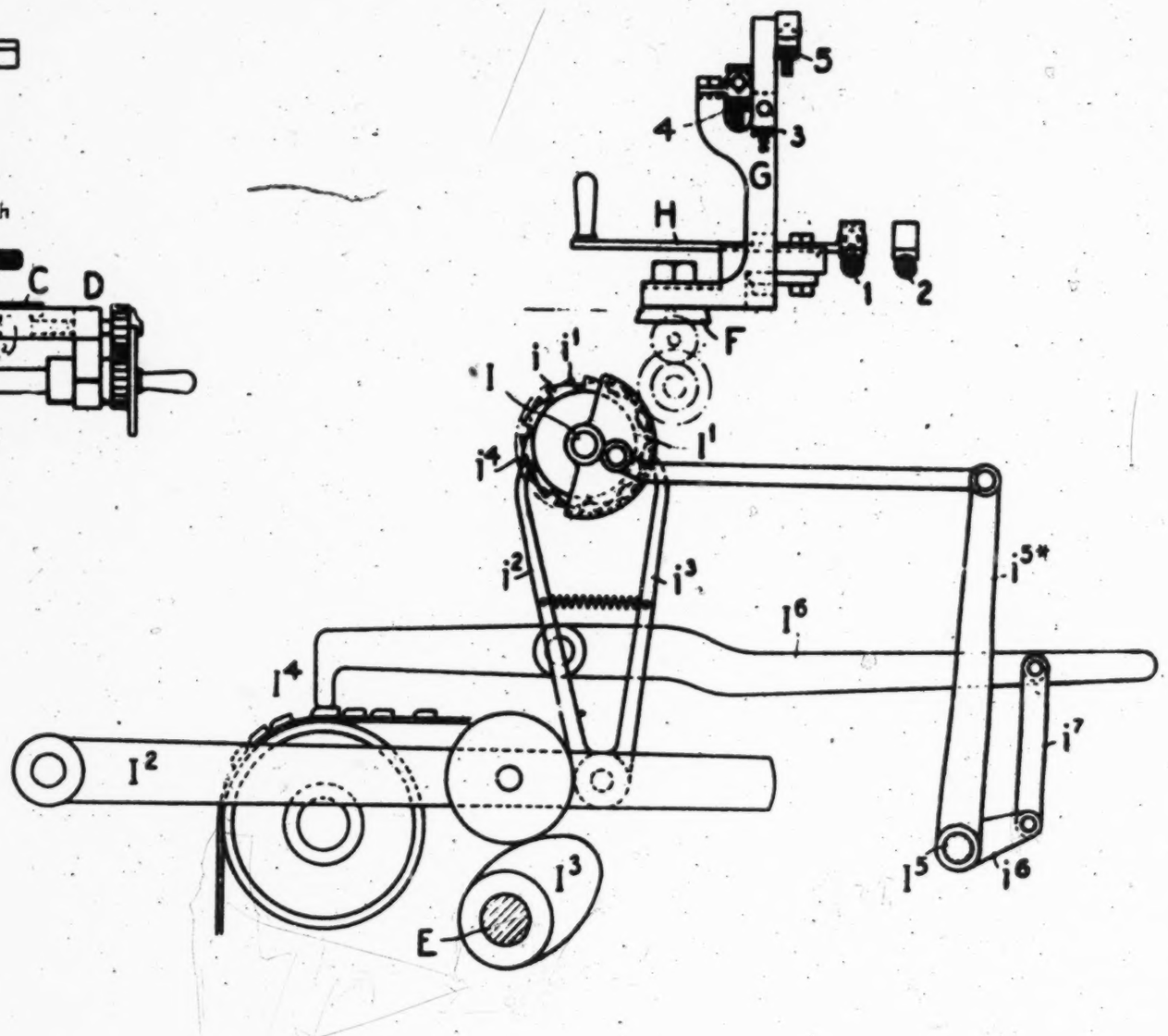


Fig. 5



DEFENDANT'S EXHIBIT A1 835

N° 7068 A.D. 1891

Date of Application, 24th Apr., 1891
Complete Specification Left, 21st Jan., 1892—Accepted, 5th Mar., 1892

PROVISIONAL SPECIFICATION.

Improvements in Knitting Machines of the Straight Bar Type, and in the Method of Fashioning Fabrics thereon.

I, JOSEPH AUGUSTUS CLARINGBURN Hosiery Machinist, Liverpool Street, Nottingham, do hereby declare the nature of this invention to be as follows:—

The object of this invention is to enable machines to make fabrics such as ladies' vests with widenings on the two outside or two inside selvages of one or more pieces of work, as in making the gores in ladies' vests. By the method herein below explained, vests can be made and at the gores the four selvages forming the splits can be widened and narrowed so that afterwards they only require seaming to form a full bosomed gore.

For example, in making a lady's vest the plain part of the body is first made up to where the gores commence then the part of the vest between the gores is pressed off, the carrier being locked in the centre and the thread unbroken: the work is then continued on the two outside pieces which are widened on the inside as far as the centre of the gores and then narrowed again to the required width, these pieces are then pressed down on the needles and the piece between the breast pleates is put on the needles again and widened on both sides up as far as the centre of the gores, it is then narrowed to the required width, the outside pieces are then raised on the needles and the whole width of the vest proceeded with in the usual manner. It will readily be seen by the above description that splits will be made which only require seaming to complete the gores.

In order to accomplish the above it is necessary to be able to widen on either side of a piece of work with the screw at one end of a machine and also to have a filling-up point on either side of each narrowing brass one at a time being used, the one in use depending upon the direction in which the widening is being made; when narrowing both are out of action.

In order to carry out my invention I use three carriers, the first one of which is used for ordinary work and is actuated in the usual manner, the second one I use for laying the thread for the left-hand piece of the three pieces of work in making a lady's vest, and it is stopped for the outside selvage by a fixed stop on the bracket carrying the left-hand narrowing screw, while for stopping it for the inside selvage which requires widening, it passes through a lug on the left-hand screw-box and has a collar on the end of it which comes into contact with the lug. This left-hand screw-box also racks in or out the left-hand narrowing points, so that the narrowing points and thread-carrier are always at the same needle.

The third carrier-rod is used in exactly the same manner for the right-hand piece of work and the filling-up points are worked in the usual manner.

Dated this 23rd day of April 1891.

JOSEPH AUGUSTUS CLARINGBURN.

COMPLETE SPECIFICATION.

Improvements in Knitting Machines of the Straight Bar Type, and in the Method of Fashioning Fabrics thereon

JOSEPH AUGUSTUS CLARINGBURN Liverpool Street Nottingham Hosiery Machinist do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My improvements relate to straight bar knitting machines of the Cotton's type

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and are for the purpose of manufacturing what is known as vests with divided breast gores and similarly fashioned articles.

In the manufacture of a vest with divided gores the work is started at the lower end of the vest and is made in the usual way until the part for the gores is reached. At this point the fabric has to be divided into three pieces, the two outside pieces being made at one time and the centre piece either before or after the side pieces. The fashioning points used on this machine are fitted with a filling-up point on both sides of the ordinary points, so that work may be fashioned on the right and left sides by the same points.

In order that my invention and the method of making the vest may be understood, I have attached hereto one sheet of drawings upon which

Fig. 1 shows in plan the thread carriers and the stops for regulating their motion, also a portion of work during the manufacture of the side pieces of a vest.

Fig. 2 shows the work when the centre piece is being made and

Fig. 3 shows the divided gores complete before seaming while

Fig. 4 is an alternative method of making the screw box.

The lower end of the vest is made by the carrier *a* until the line *d e* Figs. 1 2 & 3 is reached when a few courses are knitted with the three carriers *a b* and *c* Fig. 1 in action, the traverse of the carriers being so arranged that the work is divided into three parts at the points *f* & *g*.

The arm *n* of the screw nut *o* is fitted with a slide n^1 carrying two stops *u* & *v*, and when starting the vest the carrier *a* is arrested by the shorter stop *v*. When the line *d e* is reached the points are racked in until their inside point is over the point *f* and the slide n^1 is moved to bring the stop *u* opposite the carrier *a*, and thus shorten its motion by a distance equal to the width of the points. The thread carriers always deliver the thread to the outside of the fashioning points, which at the start work with the outside left hand point on the line *d*. When the points are racked in to work on the edge *f k l* then the point which worked on the line *d* is some little distance from the same line & consequently the motion of the carrier *a* must be shortened by a distance equal to the distance between the line *f k l* and the point which had been working on the side *d*. After making a few courses on the three portions of the fabric, the centre portion is pressed off the needles, the carrier *a* locked in the centre of the machine, and the side pieces proceeded with.

For making work which is fashioned on the outside edges only the fashioning points are fitted with one filling-up point only, which works a few needles from the edges of the fabric, but for fashioning the work with the same points on the right and left hand edges, or as in this case on the edges *e* & *g h i* and the edges *d* and *f k l*, the fashioning points are fitted with two filling-up points. When working on the edge *e* the inside filling-up point is in action, and when on the edge *g h i* the outside point is in action, the terms inside and outside been here used in reference to the outside edges *d* and *e*.

The carrier *c* for making the left hand side piece is mounted on a rod *m* which passes through the arm *n* of the screw box *o* and its motion on the edge *d* is limited by an adjustable fixed stop *p*. The motion of the carrier *c* in the other direction that is towards the centre of the fabric is limited by a collar *q* on the rod *m*, this collar striking the arm *n* as the rod moves towards the centre of the fabric.

In the ordinary method of fashioning the fashioning points are moved inwards and the motion of the carriers decreased or the points are moved out and the motion of the carriers increased, the thread carriers always striking the inside of the stop *u*, but when making fashionings of the description shown the points travel towards the centre of the fabric from *f* to *k* and then back again along the line *k l*, and by regulating the motion of the carriers from the back or outside of the arm *n*, then as the points are moved in, the motion of the carrier is increased, and as the points are moved out the motion of the carrier is decreased.

The right hand side of the fabric is made simultaneously with the left hand

side, the thread being supplied by a carrier *b* which is mounted on a rod m^1 and its motion arrested by stops similarly arranged to those at the left hand side.

In Fig. 3 the fashioned breast gores are shown turned over on to the body of the fabric about the lines *f r* and *g s* and the same reference letters on the fabric in Figs. 1, 2 and 3 indicated the same points.

When the outside pieces have been made to the line *r s* Fig. 3, they are pressed down to the bottom of the needles and the centre piece at the line *f g* Fig. 2 run on to the needles. The carriers *b* and *c* are then locked out of action and the carrier *a* released. The fashioning points are then racked in so that the outside points can work on the edges *g* k^1 *s* and *f* k^1 *r* but this racking in of the fashioning points would also carry in the stops for the carrier *a* a distance equal to the width of the points, and to prevent this the cap n^1 is moved to bring the shorter stop *v* opposite the bar *t* and thus allow of the carrier *a* being brought to the edge of the fabric, the distance between the ends of the two stops being equal to the width of the fashioning points.

The centre piece is then made up to the same line *r s* as the side pieces, after which the upper part of the fabric is finished in the usual manner, and after being removed from the machine the left hand gore is seamed together at the edges *f k r* and *f* k^1 *r*, and the right hand gore at the edges *g* k^1 *s* and *g k s*.

When the machine is making the side pieces, the carrier rods strike the screw stops *s* and tend to move them towards the centre of the machine while the movement given to the fashioning points tend to move the screw box in the opposite direction and if through wear or other causes there was any play between the screw and the box it is evident that the motion of the carriers and fashioning points would not have the necessary accuracy. To overcome this difficulty I have shown in Fig. 4 a screw box made in two pieces A and B which are drawn together by springs C and D. The two parts of the nut are thus drawn up to opposite sides of the screw thread and prevent any movement of the nut upon the screw. The two parts of the nut may be fitted with regulating screws E and F to prevent the springs exerting undue pressure and consequently wear upon the screw or nut.

When the machine is required for making work of the ordinary description, that is, work which is fashioned on the outside edges only, the carriers *b* and *c* can be readily thrown out of action without loss of time, and the work made by the carrier *a*.

Having now described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is :—

1. The method of making on a straight bar knitting machine fashionings as described with a single fashioning screw at each end of the machine.

2. The application of a collar or its equivalent to the thread carrier rods for stopping their motion in the manner described as and for the purpose specified.

3. The construction of a fashioning screw box in two parts as shown and described for the particular purpose specified in connection with a collar or its equivalent on the carrier rod.

Dated this 20th day of January 1892.

W. H. POTTER,
Parliament Chambers, Nottingham, Agent for the Applicant.

838 A.D. 1891. April 24. N° 7068.

CLARINGBURN'S Complete Specification. 1 SHEET

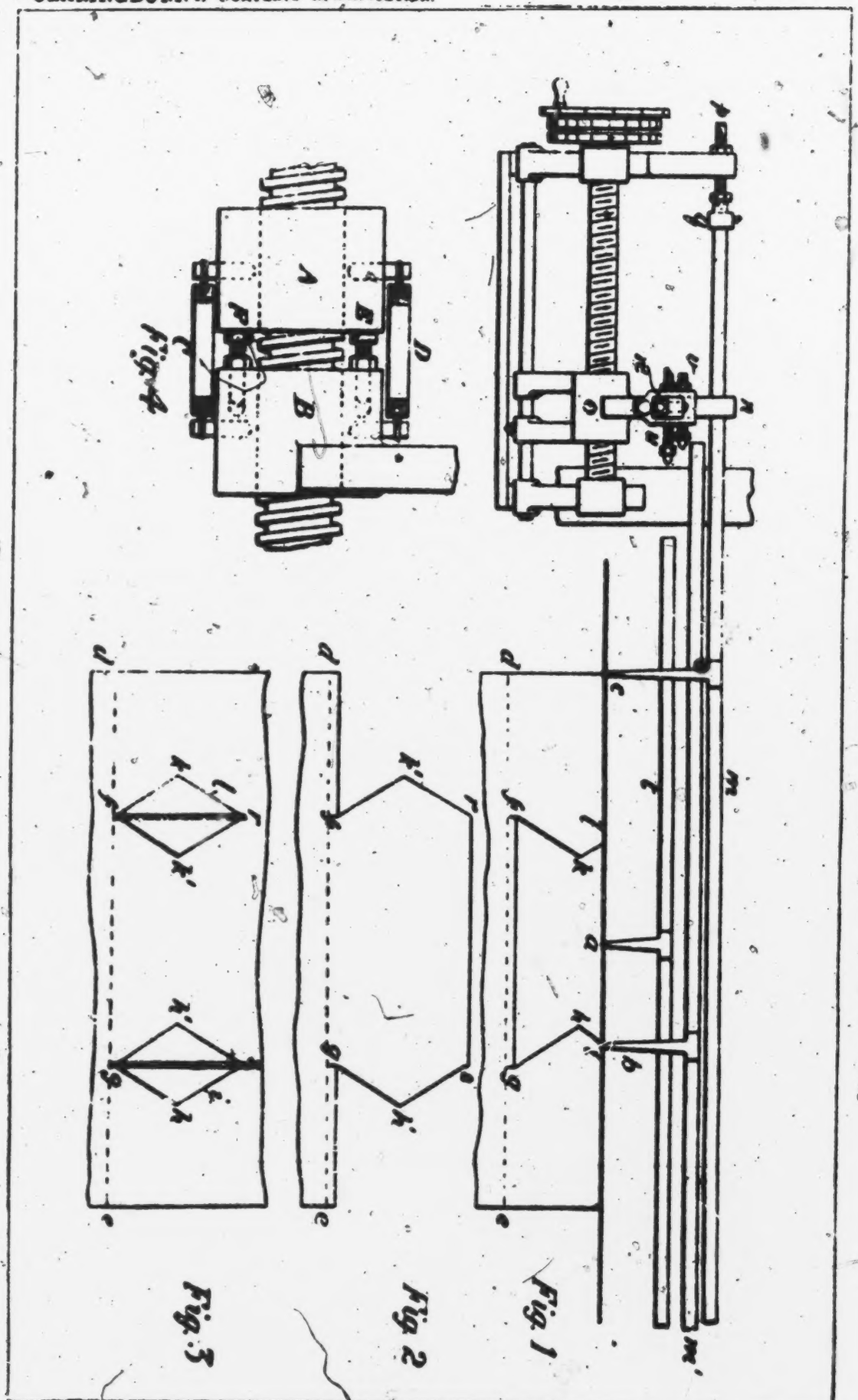

Fig. 3. Fig. 2. Fig. 1.

'This Drawing is a reproduction of the Original on a reduced scale.'

Lithographed at the Patent Office, 25 Southampton Buildings, London, W.C.
For Her Majesty's Stationery Office. 1892.

DEFENDANT'S EXHIBIT B1 839

[redacted]

KAISERLICHES PATENTAMT.

AUSGEGEBEN DEN 1. FEBRUAR

PATENTSCHRIFT

№ 117153

KLASSE 25 a.

THEODOR LIEBERKNECHT IN HOHENSTEIN-ERNSTTHAL i. S.

Pufferanordnung für die Fadenführer- und Deckerschienen von flachen Wirkstühlen.

Patentirt im Deutschen Reiche vom 15. Mai 1900 ab.

In sehr breiten Wirkstühlen, welche viele Waarenstücke *w* (Fig. 1) von gleicher Art neben einander arbeiten, werden manche Theile, z. B. die Fadenführerschienen *b* (Fig. 1 und 5), oder die Deckerschienen *d* (Fig. 5) sehr lang. Nun bildet das Maschinengestell, welches die Nadelreihen *e* (Fig. 1) in einzelnen Abtheilungen (Fonturen) trägt, einen langen und sehr starken Körper von grofser Masse, und die Schienen *b d* sind ebenso lang, aber dünn und von kleiner Masse. Bei Aenderung der Temperatur, z. B. wenn im Winter früh die kalten Arbeitsräume angeheizt werden, durchwärmen die dünnen Schienen *b d* viel schneller als das massige Gestell, sie dehnen sich also auch zunächst mehr aus als das letztere und dann passen in den ersten Arbeitsstunden die Theile nicht richtig zusammen. Wenn z. B. die Schiene *b* (Fig. 1) links am Puffer *f* anliegt, so ist der erste Führer *c* bei 1 wohl noch richtig zwischen der Randnadel *e* (Fig. 3) der Waare und der nächsten äufseren Nadel e_1, beim nächsten Führer 2 ist aber *b* schon im Stücke *f* bis 2 etwas mehr ausgedehnt als das Gestell und der Führer steht wie 2 in Fig. 3 etwas näher an *e*, der dritte Führer 3 rückt noch dichter an *e* und schliefslich kommen weitere Führer bis auf oder über die Randnadeln *e* der Waaren, wodurch natürlich Fehler entstehen: die Randmaschen sind unregelmäfsig oder fehlen. Die Erfahrung zeigt, dafs bei 12 bis 16 Strümpfen und feiner Theilung der Unterschied in der Ausdehnung schon recht leicht eine halbe Nadeltheilung betragen kann, wodurch der Stuhl so lange unbrauchbar wird, bis die Theile alle gleichmäfsig erwärmt sind. Die Decker zeigen denselben Fehler, denn die Decknadeln *g* (Fig. 4) treffen nach und nach mit ihren Spitzen nicht in die Mitte der Stuhlnadelrinne, wie 1, sondern zur Seite auf den Rand, wie 2, 3 u. s. w., wobei sie noch immer richtig arbeiten, bis sie endlich über den Rand und über die Nadel *e* hinausfallen, womit der Stuhl ebenfalls unbrauchbar wird.

Das nächste Mittel zur Abhülfe würde nun sein, die Schienen *b d* zu theilen und für jeden Theil besondere Mitnehmer und Puffer anzubringen, aber das ist umständlich und theuer. Die vorliegende Neuerung besteht deshalb darin, dafs die Puffer *f* f_1 nicht an den beiden Enden der Maschinen, sondern in der Mitte der letzteren, oder, wenn nicht gerade die Mittellinie gewählt wird, so doch jedenfalls innerhalb der Fonturen angeordnet werden, wie Fig. 2 zeigt. Stöfst hier die Schiene *b* mit *i* an *f*, so ist zunächst der erste Führer 1 links von *i* noch in richtiger Stellung, die nächsten Führer 2 links und rechts von *i* rücken näher, theils an die Aufsennadel e_1 (Fig. 3), theils an die Randnadel *e*, die nächsten 3 noch näher u. s. f. Aber diese Annäherung setzt sich nur bis zur Hälfte der Anzahl Führer fort, der Fehler wird also höchstens halb so grofs wie bisher, und dieser ist unschädlich; denn die Führer bleiben noch zwischen den Nadeln *e* e_1 (Fig. 3) und die Decknadeln bleiben innerhalb der Nadel-

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rinne Fig. 4. Man kann also mit dieser neuen Anordnung den Stuhl doppelt so breit bauen als bisher.

In Fig. 5 ist die Einrichtung an einem Cottonstuhle angedeutet, derart, dafs die Pufferstücke *f* für die Fadenführerschienen *b* nahezu in derselben Höhenlage wie bisher liegen, diejenigen für die Deckerschienen *d* aber oben bei *h* angebracht sind, beides inmitten der Maschinenbreite, wie in Fig. 2 $f f_1$. Damit stören die Puffer die Fonturen *c* nicht, und da sie an beiden Seiten in Wegfall kommen, so wird der Stuhl schmäler oder man kann an ihm bei gleicher Breite nun mehr Fonturen anbringen, mehr Waarenstücke *w* arbeiten als bisher.

Es gäbe wohl auch den anderen Weg, dafs man inmitten der Maschine eine Fontur oder zwei wegnähme und den freien Platz für die Puffer benutzte; damit wird aber die Arbeit vermindert infolge des Verlustes zweier Fonturen, und es soll das hier nur erwähnt werden, um ein Umgehen der Erfindung zu verhindern.

Patent-Anspruch:

Pufferanordnung für die Fadenführer- und Deckerschienen von flachen Wirkstühlen, dadurch gekennzeichnet, dafs die Puffer nicht an den Seiten, sondern in der Mitte des Stuhles bezw. innerhalb der Fonturen liegen, die genannten Schienen sich also seitlich von den Anstofsstellen erstrecken und somit ihre Ausdehnungsverschiedenheit gegen die ganze Stuhlbreite geringer als bisher und damit unschädlich gemacht wird.

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Hierzu 1 Blatt Zeichnungen.

[fol. 841] DEFENDANT'S EXHIBIT B-1

German Patent # 117153, Class 25 a

Theodor Lieberknecht in Hohenstein—Ernstthat, Saxony,

Stop Arrangement for the Carrier and Narrowing Rods of Flat Knitting Machines

Patented in the German Empire May 15, 1900

In the very wide knitting machines working many pieces of fabric at one and the same time, w (fig. 1), certain parts, for example the thread carrier rods b, (fig. 1 and 5), or the narrowing rods d, (fig. 5), are very long. The frame, holding the rows of needles e (fig. 1) in individual sections, forms a long and very rigid body of great strength, and the rods b, d, are just as long but thin and of less strength. When the temperature changes, as for example during the winter early in the morning, while the rooms are being heated, the thin rods b, d, are warmed up more quickly as the massive frame and they, therefore, expand more readily than the latter and then during the first working hours, the various parts do not fit together properly. If, for example, rod b, (fig. 1) rests left at the stop f, the first carrier c, at position 1, is still in the correct place between the selvedge needle e, (fig. 3) of the fabric and the next needle, e_1; in the case of the next carrier 2, however, b in f to 2, has already expanded more than the frame, and the carrier is in the position 2 as shown in fig. 3 somewhat nearer to e; the [fol. 842] third carrier moves still closer to e, and finally other carriers expand on top or beyond the selvedge needles e of the fabric, whereby, of course, seconds in the fabric occur; the selvedge loops are irregular or are missing entirely. Experience has shown that in the case of 12 to 16 sections and fine gauge, the variation in the expansion can easily be half of the space between the needles, whereby the machine becomes inoperative until all parts have been warmed up uniformly. The narrowing fingers show the same tendency, for the narrowing needles g, (fig. 4), by and by with their points do not position themselves in the middle of the knitting needle groove, as 1, but sideways of it on the edge, as 2, 3, etc., whereby they are still working correctly, until finally they expand over the edge and over the needle e, in which case the machine has again become inoperative.

The next best means of eliminating this condition would be to divide the rods b, d, and to create for each part special dogs and stops. However, this is troublesome and expensive. The present invention, therefore, consists in that the stops f, f_1, are not on both ends of the machine, but in the middle thereof, or, if not exactly the centre is chosen, at any rate in between the sections as is shown in fig. 2. If in this manner rod b with i comes in contact with f, the first carrier 1, left of i, is still in the correct position; the next carrier 2, left and right of i, move closer, partly to needle e_1, (fig. 3), and partly to selvedge needle e; the next 3 still closer, etc., but the approach extends only over half of the number of carriers so that the incorrect adjustment is only half as great as heretofore, and this is without bad effect, for the [fol. 843] carriers still remain between the needles ee_1, (fig. 3), and the narrowing needles still remain within the needle groove (fig.). In other words, with this new arrangement it is possible to build the machine twice as long as heretofore.

In figure 5 is shown the attachment on a flat knitting machine in such a manner that the stops f for the thread carrier rods b, are arranged at nearly the same height as heretofore; those of the narrowing rods d, however, attached on top at h, both in the centre of the machine as in fig. 2 ff_1. In this manner the stops do not interfere in any way with the sections e, and as they are not mounted at the ends, the machine becomes shorter, or it is possible in the same width to build in more sections so that more pieces of fabric w can be made as heretofore.

There would also be the other way, by leaving out in the centre of the machine one or more sections and to use the section space for the stops. In that way, however, the amount of production becomes smaller because of the loss of production of two sections, and this is mentioned here only to avoid a circumvention of the invention.

Patent-Claims

Stop arrangement for the thread carrier and narrowing rods of flat knitting machines, typical in that the stops are not placed at the sides but in the centre of the machine in between the sections so that the named rods extend themselves sideways of the stops and whereby the possibility of expansion over the entire machine becomes less than heretofore and also becomes without effect upon the satisfactory operation of the machine.

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THEODOR LIEBERKNECHT IN HOHENSTEIN-ERNSTTHAL i. S.

Pufferanordnung für die Fadenführer- und Deckerschienen von flachen Wirkstühlen.

Fig. 1.

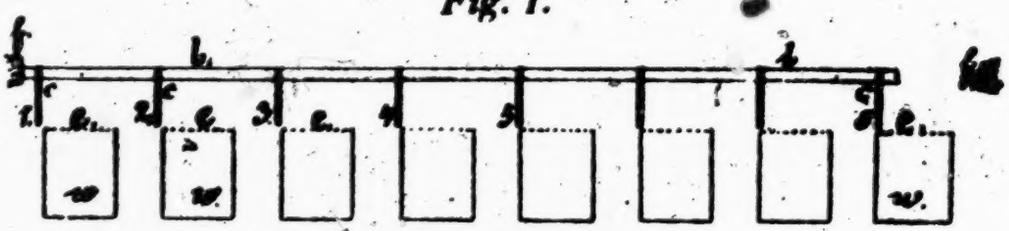


Fig. 2.

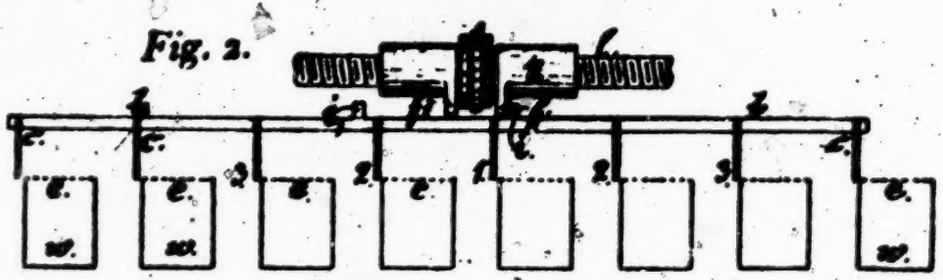
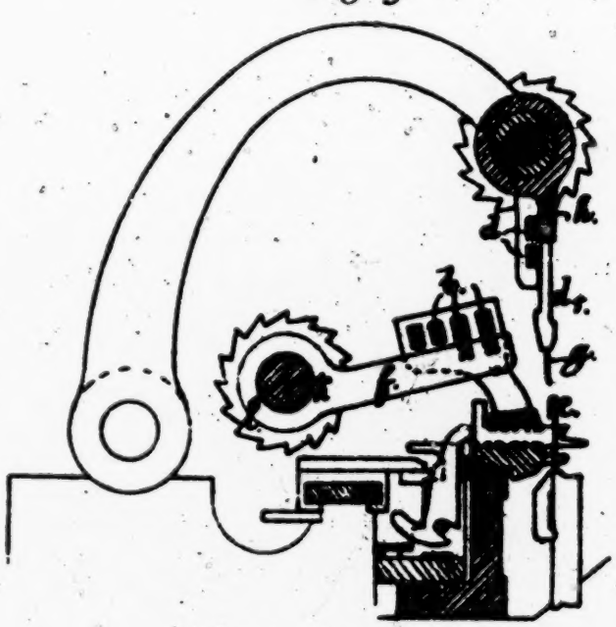


Fig. 3.

Fig. 4.

Fig. 5.



Zu der Patentschrift

№ 117153.

PHOTOGR. DRUCK DER REICHSDRUCKEREI

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DEFENDANT'S EXHIBIT C1

PATENT SPECIFICATION

Application Date: Dec. 2, 1922. No. 32,962/22.

Complete Left: Aug. 31, 1923.

Complete Accepted: Dec. 20, 1923.

208,362

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PROVISIONAL SPECIFICATION.

Improvements in Rotary or Straight-bar Knitting Machines.

We, WILLIAM COTTON, LIMITED, of Pinfold Gate, Loughborough, Hosiery Machinists, a company organized under the laws of Great Britain, and CHARLES HENRY ALDRIDGE, Managing Director, British subject, of the same address, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in connexion with rotary or straight-bar knitting machines, and is particularly adapted to the type known as "Cotton's patents", but is also applicable to other types of straight-bar knitting machines.

The improved mechanism hereinafter described has particular reference to such arrangements as are applied to a "Cotton's patent" or similar knitting machine for "splicing" or knitting in an extra thread to strengthen certain parts of hosiery or underwear, as well understood by all conversant with knitting machinery, and it is more particularly designed for effecting improvements when (what is known as) "high splicing" in hose or the like is being made, and where the top of the splicing is graduated so as to rise to a point or inverted V shape at the back of the leg and this is pretty generally known as "graduated splicing"

In order to produce the graduations desired the ordinary well understood splicing carrier rods are stopped (by the usual selvedge or sliding stops) at the selvedges, and by certain arrangements of variable stops, whereby the splicing carriers needles starting their thread from the selvedges (as when making hose) gradually increase the length of draw or traverse of carriers at certain successive stages until they reach the full width of splicing desired.

The mechanism now to be described consists of improved variable stops and associated parts automatically controlling the varying length of traverse of the splicing carriers as desired.

We arrange a fixed bed or bar at a convenient position on the machine, preferably in one of the end divisions. Upon this bed two nuts or screw boxes are fitted and free to slide. A right and left hand screw passes through these nuts and is carried by suitable bearings attached to the said bed, so that by rotating the said screw the two nuts or boxes approach or recede from one another.

Each nut is provided with an adjustable stop (bolt or finger) which (when in action) lies in the path of a bracket or equivalent attached to each of the splicing carrier rods or other convenient connected part or parts. The stop on one nut acts upon one splicing carrier rod and the stop on the other nut likewise acts upon the second splicing carrier rod, all being so set and adjusted that when the splicing is started the said stops are in such a position as to stop the traverse of the splicing carriers practically at the selvedges or other desired starting points, and as the said screw is rotated the stops are shifted a distance of one of more needle spaces as desired and the traverse of the splicing carriers is thereby increased as and when the screw is turned.

The said screw is turned by means of a rack wheel and ratchet or equivalent to which action is imparted as and when required by a cam on the cam shaft.

In this class of splicing it is generally found desirable that the traverse of the splicing carriers should be increased an amount equal to one needle space or a two needle space at each increase of traverse as desired. To do this we form the teeth of the ratchet as a separate part and fasten this part to the ratchet arm in such a manner that it is adjustable thereon, so that when the

said part is in one position the screw is racked for a one needle space, and when in another position the screw is racked for a two needle space, or other space or spaces as desired.

It will be noticed that there might be danger of the nuts jamming if the ratchet were not stopped at the right time.

To avoid this we arrange a knocking-out-lever which is held out of action by a prop or equivalent, which in turn is connected to one of the nuts by an adjustable connecting rod in such a manner that at any desired position in the traverse of the nuts, the said prop is withdrawn and the ratchet is automatically knocked out of action.

Dated the 2nd day of December, 1922.

CARPMAELS, RANSFORD & NEWTON,
Agents for Applicants,
24, Southampton Buildings, London, W.C. 2.

COMPLETE SPECIFICATION.

Improvements in Rotary or Straight-bar Knitting Machines.

We, WILLIAM COTTON, LIMITED, of Pinfold Gate, Loughborough, Hosiery Machinists, a company organised under the laws of Great Britain, and CHARLES HENRY ALDRIDGE, Managing Director, British subject, of the same address, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in connexion with rotary or straight-bar knitting machines, and is particularly adapted to the type known as "Cotton's patents", but is also applicable to other types of straight-bar knitting machines.

The improved mechanism hereinafter described has particular reference to such arrangements as are applied to a "Cotton's patent" or similar knitting machine for "splicing" or knitting in an extra thread to strengthen certain parts of hosiery or underwear, as well understood by all conversant with knitting machinery, and it is more particularly designed for effecting improvements when (what is known as) "high splicing" in hose or the like is being made, and where the top of the splicing is graduated so as to rise to a point or inverted V shape at the back of the leg and this is pretty generally known as "graduated splicing".

In order to produce the graduations desired the ordinary well understood splicing carrier rods are stopped (by the usual selvedge or sliding stops) at the selvedges, and by certain arrangements of variable stops, whereby the splicing carrier needles starting their thread from the selvedges (as when making hose) gradually increase the length of draw or traverse of carriers at certain successive stages until they reach the full width of splicing desired.

The mechanism now to be described consists of improved variable stops and associated parts automatically controlling the varying length of traverse of the splicing carriers as desired.

We arrange a fixed bed or bar at a convenient position on the machine, preferably in one of the end divisions. Upon this bed two nuts or screw boxes are fitted and free to slide. A right and left hand screw passes through these nuts and is carried by suitable bearings attached to the said bed, so that by rotating the said screw the two nuts or boxes approach or recede from one another.

Each nut is provided with an adjustable stop (bolt or finger) which (when in action) lies in the path of a bracket or equivalent attached to each of the splicing carrier rods or other convenient connected part or parts. The stop on one nut acts upon one splicing carrier rod and the stop on the other nut likewise acts upon the second splicing carrier rod, all being so set and adjusted that when the splicing is started the said stops are in such a position as to stop the traverse of the splicing carriers, practically at the selvedges or other desired starting points, and as the said screw is rotated the stops are shifted a distance of one or more needle spaces as desired and the traverse of the splicing carriers is thereby increased as and when the screw is turned.

This invention is illustrated by the accompanying drawing which shows the arrangements herein described together with some adjacent parts; other parts not shown are well understood by all conversant with full fashioned knitting machinery.

Fig. 1 is a front view of the special appliances, together with a pair of splicing carrier needles as ordinarily applied to a single division of a

"Cotton's patent" hose frame. Fig. 2 is a part section of same, and Fig. 3 is an end view of parts of same, showing the racking mechanism.

In Fig. 2 a needle A and a sinker A^1 are shown, together with the head A^2 and the slur bar B in order to localise the adjacent parts.

C^1 C^2 are splicing carriers, which are fast to the splicing carrier rods C^3, C^4 which slide in the usual well understood manner in suitable bearings, are driven by any usual well understood friction mechanism, the length of the traverse being controlled by the usual stop arrangement. The sliding stops control and stop the carriers at their respective selvedges, and the stationary stops at any width from the selvedges as required, according to the width of a splicing (generally known as high splicing) desired. All this is well understood by all conversant with full fashioned hosiery machinery.

This form of splicing has generally been made, as in the case of a hose for instance, so that the ankle splicing starts with a straight line round the back of the leg, but in some cases the top of the splicing is graduated so as to rise to a point, or inverted V shape at the back of the leg.

The invention herein described relates to special mechanisms controlling special supplementary stops (which are used in addition to the usual sliding stops and stationary stops above referred to) for effecting the graduation of traverse of the splicing carriers desired.

D is a fixed bed or bar, carried by brackets D^1 by any convenient part of the framing of the machine. D^2, D^3 are two screw boxes or nuts, free to slide thereon. D^4 is a right and left hand screw, passing through the nuts D^2, D^3 and carried by suitable bearings fast to the bed D, and it will be seen that by rotating the said screw D^4 the two nuts approach, or recede, one from the other according to the direction of rotation of the screw D^4. Each nut is provided with a suitable stop finger, or equivalent, D^5, D^6 which may be pivoted as shown D^5 on D^2 and D^6 on D^3. The carrier rod C^3 is provided with a suitable stop C^5 fast thereto, and the carrier rod C^4 with a similar stop C^6, with which the said stop fingers D^5 D^6 may engage when in the positions shown in full lines or the fingers D^5 D^6 may be turned up out of action, (as shown in dotted lines in Figure 2) when not required. These stops are so arranged and adjusted that when the screw nuts D^2, D^3 are at their widest distance apart, and the fingers D^5 D^6 are down the splicing carrier needles C, C^1, will remain at their respective selvedges, as shown in full lines in Fig. 1. It will now be seen that if the screw D^4 be suitably rotated at each course of work, the traverse of the splicing carriers C, C^1 will be increased at each draw and the width of the splicing will be gradually increased until the splicing carriers C, C^1 reach the positions indicated by dotted lines, as controlled by the ordinary splicing stops, or by automatically stopping the racking of the screw D^4, as hereinafter described, and the form of the splicing will be as indicated by the dotted area in Fig. 1, starting from the points C^8, C^9 and widening out to the full width of splicing C^8, C^9 and C^{10}, C^{11}.

The said screw is turned by means of a rack wheel and ratchet or equivalent to which action is imparted as and when required by a cam on the cam shaft.

In this class of splicing it is generally found desirable that the traverse of each of the splicing carriers should be increased an amount equal to one needle space or a two needle space at each increase of traverse as desired. To do this we form the teeth of the ratchet as a separate part and fasten this part to the ratchet arm in such a manner that it is adjustable thereon, so that when the said part is in one position the screw is racked for a one needle space, and when in another position the screw is racked for a two needle space, or other space or spaces as desired.

This will be understood by referring to the drawings. D^7 is a rack wheel fast to the screw D^4. This wheel is provided with pegs D^8, with which the teeth of the ratchet D^9 engage. This rack wheel is provided with a suitable retaining spring or equivalent, not shown but well understood. The part D^9 in which the ratchet teeth are formed is attached to the arm or member D^{10} which receives a suitable up and down movement by a truck lever and cam, not shown but well understood. The ratchet D^9 is held in contact with the pegs D^8 by a spring D^{11}.

The ratchet D^9 is attached to the arm D^{10} by a suitable screw or screws, passing through slots in the ratchet, the said slots being of such a length as to permit the ratchet being raised or lowered on the arm D^{10}, a distance equal to the pitch of the pegs D^8.

The ratchet is shown in full lines (Fig. 3) at the bottom of its movement and engaging with the pegs D^8, and it is shown in dotted lines in its raised position, and it will be understood that in this movement it will have racked the screw round a distance of two pegs, which

may be taken, in this instance, as representing a movement of the stops D^5 D^6 (Figure 1) a distance equal to one two needle space. It will now be seen that if the ratchet be lowered on the arm D^{10}, a distance of one tooth (as hereinbefore described), the first half of its rising movement will not move the rack wheel D^7, and the second half of its movement only will be operative and rack the wheel a distance of one peg, and the stops D^5 D^6 a distance of one needle.

It will be noticed that there might be danger of the nuts jamming if the ratchet were not stopped at the right time.

To avoid this we arrange a knocking-out-lever which is held out of action by a prop or equivalent, which in turn is connected to one of the nuts by an adjustable connecting rod in such a manner that at any desired position in the traverse of the nuts, the said prop is withdrawn and the ratchet is automatically knocked out of action.

E is the knocking-out-lever pivoted on a pin or axle E^1 and carrying a pin E^2 which is arranged to pass in front of the ratchet arm D^{10} but which in the position shown in full lines does not touch it. A prop F pivoted at F^1 is so arranged that in its normal position it supports the knocking-out-lever E in the position shown in full lines, and is retained in this normal position by a spring such as F^4 attached to the right hand bearing of the screw D^4 (Figure 1). A rod or bar F^3 jointed to this prop F passes over the nut D^3, resting on a lug F^2 carried by the nut D^3. The rod F^3 carries an adjustable stop such as shown at F^3 (Figure 1) which may engage with the nut D^3, when it is racked in a certain distance, so that the further movement of the nut draws the prop F from under the knocking-out-lever E, and so at a predetermined position of the nut D^3, the knocking-out-lever E is drawn down by the spring E^3 (Fig. 3) and the pin E^2 on the lever E engages with the top end of the racking arm D^{10}, and moves the teeth on the part D^9 out of contact with the pegs on the rack wheel D^7 as indicated by dotted lines, and thus the inward movement of the two stops D^5, D^6 carried by the nuts D^3, D^3 is automatically stopped as and when desired.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A rotary or straight bar knitting machine which is adapted for producing a graduated width of splicing and which has adjustable sliding stops controlled by a right and left hand screw so that the rate of graduation can be varied as desired.

2. A knitting machine according to Claim 1 in which the right and left hand screw is controlled by an adjustable ratchet, so that a constant movement of a racking arm can produce a varied movement of the screw.

3. A knitting machine according to Claim 1 and having an adjustable stop, whereby the screw can be automatically stopped as described, substantially as described.

4. A rotary or straight bar knitting machine provided with mechanism substantially as hereinbefore described with reference to the drawing.

Dated the 31st day of August, 1923.

CARPMAELS, RANSFORD & NEWTON,
Agents for Applicants,
24, Southampton Buildings, London,
W.C. 2.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1924.

708

849

DEFENDANT'S EXHIBIT D1

Knitting Mathematics and Mechanisms

PREPARED FOR THE TEXTILE TRADES ADVISORY COMMITTEE OF THE CITY OF LEICESTER MUNICIPAL TECHNICAL AND :: :: ART SCHOOLS :: ::

BY

JOHN CHAMBERLAIN

SILVER MEDALLIST CITY AND GUILDS OF LONDON INSTITUTE. HOSIERY MANUFACTURE AND WOOL DYEING: HEAD OF TEXTILE DEPARTMENT, CITY OF LEICESTER TECHNICAL SCHOOL.

LEICESTER:

J. W. HEMMINGS & CAPEY,
PRINTERS,
CHARLES STREET.

1923.

709

850

tion of the worm shaft. To obtain the maximum amount of contact and wear, it is often found advisable to cut concave teeth on the worm wheel. Worm gearing is used largely for driving the drawing-off rollers of circular machines.

Drunken worms are used where the movement of the worm wheel is required to be intermittent. In this case the thread spiral is not continuous, and for a part of the revolution of the worm shaft no movement is transmitted.

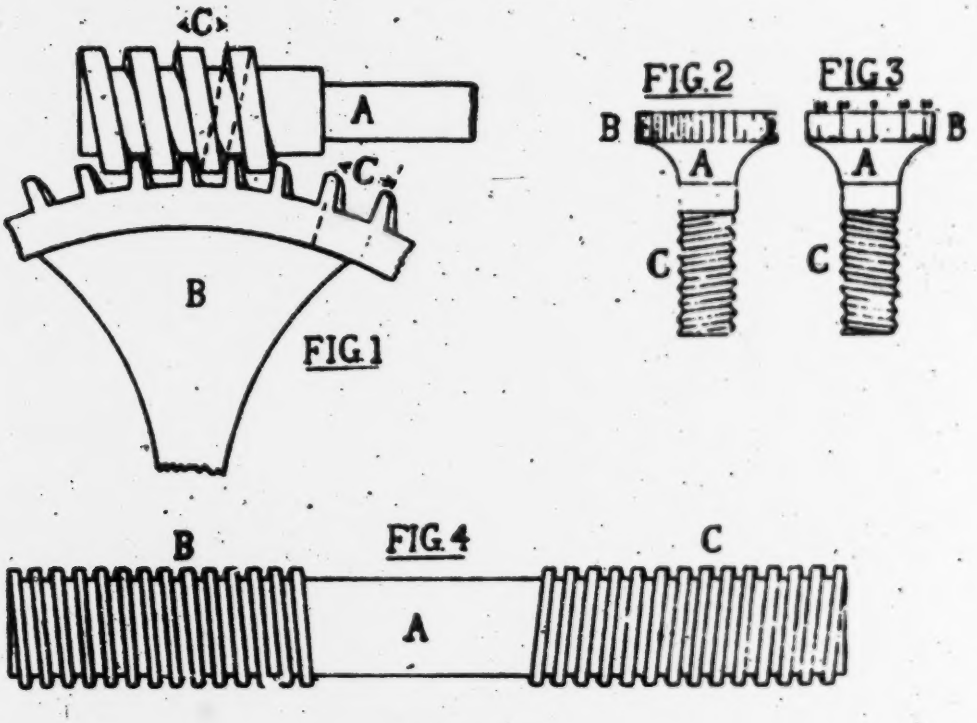

Diagram 8

WORM GEAR AND SCREW THREADS.

A special form of drunken or intermittent worm is used on warp knitting machines, and is known after the name of its inventor, as a "Dawson" wheel. This form of intermittent worm is often used instead of a ratchet wheel where a number of movements are required in one revolution of the shaft, as the action is steadier and more positive.

Screws and Screw-Threads.—Owing to the fact that knitting machines are built both on the Continent and in America, as well as in Great Britain, there is a large variety of threads used. Even

the British builders in some cases use bastard sizes and bastard threads instead of the standard Whitworth and British Association threads. This often causes unnecessary trouble and it is advisable to keep a stock of screws of each class to prevent machines from standing idle whilst screws are fitted. Knitting machines abound in set-screws as many minor adjustments are necessary to effect slight alterations in the stitch length, position of cam rollers and controlling levers. Micrometer screws should be used for adjusting the positions of the stitch cams as very fine adjustments have to be made. Typical examples of these are shown in Figs. 2 and 3, Diagram 8. Set screw A (Fig. 2) has a disc-like head, the edge of which is cut into V-shaped notches B, a small spring retaining the screw in a given position. This thread (C) is right-handed, although in some cases a left-hand thread is used, as shown in Fig. 3 at C. The head B of the set screw A in Fig. 3 is divided into 100 parts so that alterations may be made with exactness and without counting, although in this case a locking screw is required to keep the screw in position. A micrometer screw having 20 threads per inch and 100 divisions marked on the head enables the operating parts to be adjusted to .0005 of an inch. The necessity of the micrometer adjustment was realised in the early days of the hand frames which were fitted with deep star nuts, left-hand thread, with from 50 to 100 nicks round the edge. No locking screw was needed as the nut was spring retained. In spite of this early use of the micrometer nut many modern knitting machines have very crude adjustments, and in some cases the stitch cams cannot be adjusted individually to take up any uneven wear. Micrometer screws with numbered divisions are a great asset, especially on the multi-feeder machines, where frequent alterations are required in the stitch length.

Screw-threaded spindles are used on winding machines for raising the guides as the bobbins fill. In these cases square, vee, and saw-tooth threads are all used.

Another use of the square thread is for gradually reducing or increasing the traverse of yarn guides. Fig. 4, Diagram 8 shows a spindle A cut with right-hand thread B and left-hand thread C. Rotation of this spindle will cause screw-boxes or specially constructed nuts to move in opposite directions for the purpose previously mentioned.

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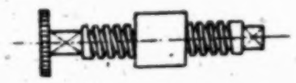
A somewhat unusual application of the screw thread in knitting machines is found on certain power purl machines where the continued rotation of a screw spindle causes the cam carriage to traverse across the needle beds. To effect this in both directions straight and crossed belts are used, the belts being automatically shifted .. om fast to loose pulley, and vice versa as the carriage reaches the end of its traverse. The only use of the screw for the application of pressure is to be found in the older types of steam presses where the upper bed is raised and lowered by means of a long handle attached to the screw spindle.

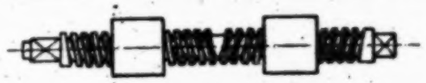
Speed Gears.—In order to obtain maximum speed on certain knitting machines it is found necessary to conduct certain operations at a lower speed than that used in the normal knitting. These machines include straight-bar machines, rib top machines, and seamless hosiery machines. Usually the gear is of a simple countershaft type, an example of which is shown in Diagram 9. A is the shaft of a seamless hose machine. Encircling this shaft is the driving sleeve B to which is attached the pinion C with a cut boss P. The handle E is fastened to the sleeve by the screws F. Three pulleys G, D, and J are used, G being the loose pulley which runs freely on the boss of the low speed pulley D. A slot is cut in the boss of pulley D to receive the projections on the handle E so that the pulley is secured to the sleeve B. Hence a direct drive is obtained either by turning the handle E or by driving pulley D. The high speed pulley J is free on the sleeve B and has attached to it by the screws S the toothed wheel K. When the belt is on the pulley J, the wheel K drives the wheel M which is attached to the countershaft L. The latter also carries the spur wheel N which drives the pinion C and the sleeve. The countershaft L is carried on a bracket Y attached to the housing Q. The sleeve runs in a long bearing also screwed to the housing Q. The increase in speed is dependent upon the numbers of teeth in the drivers and followers, the usual increase being 20 to 25%. The high speed is obtained through the gears in order that the machine in starting from rest may be driven first at the low speed. The change in speed is obtained automatically by the moving of the belt fork.

A type of epicyclic gear is used on the X.L. types of machines, the whole of the gear wheels being enclosed within the pulleys.

—SPINDLES OF PRIOR ART—



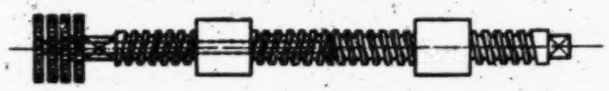
REGULAR COTTON CARRIER END STOPS.

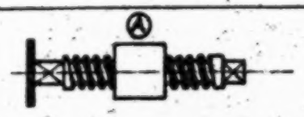


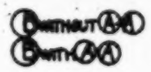
J.H. WOODWARD BRI. 13,627 1851

LAMB AND NOON BRI. 15,123 1885

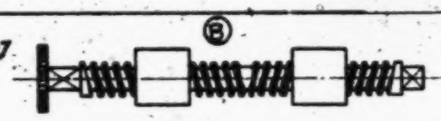
W.T. ROWLETT U.S. 500,953 JULY 11, 1892

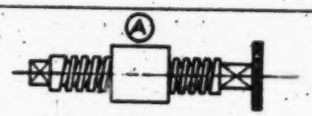


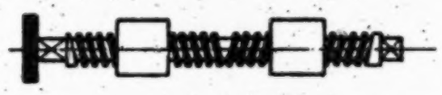




J.B. MEIXNER BRI. 7476 1837
GOTHAM PRIOR USE

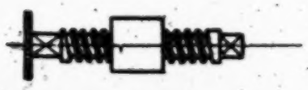




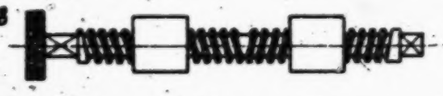


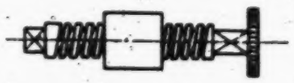
J. MILLER U.S. 1,564,438 OCT. 20 1923

T. LIEBERKNECHT U.S. 981,663 MAY 25, 1910

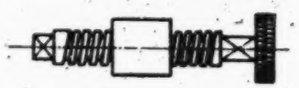


R.E. SCHLETTER U.S. 1,713,628
JUNE 19, 1922
NOV. 5, 1925

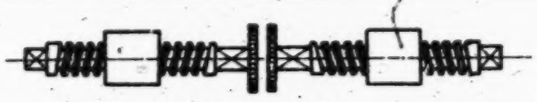




G. SOUTER U.S. 478,527 OCT. 22, 1889



E. ROE BRI. 1931 1869



H. WILLATT BRI. 573 1871

W.E. CHAPMAN U.S. 1,163,370 NOV. 2, 1910
(NOT FOR CARRIER STOP)

854
DEFENDANT'S EXHIBIT F1

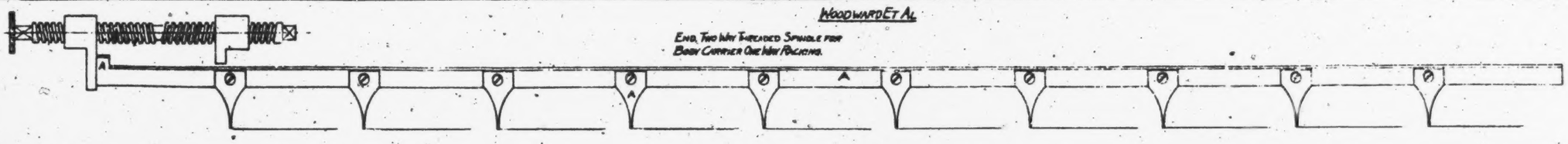
—SPINDLES AND CARRIERS—

SHEET 2

7

WOODWARD ET AL

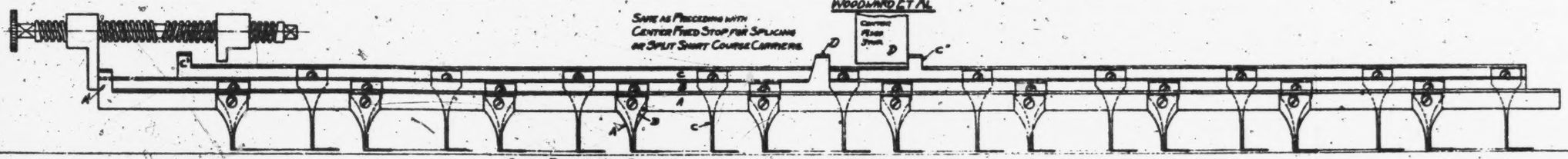
END, TWO WAY THREADED SPINDLE FOR BODY CARRIER ONE WAY PICKING.



8

WOODWARD ET AL

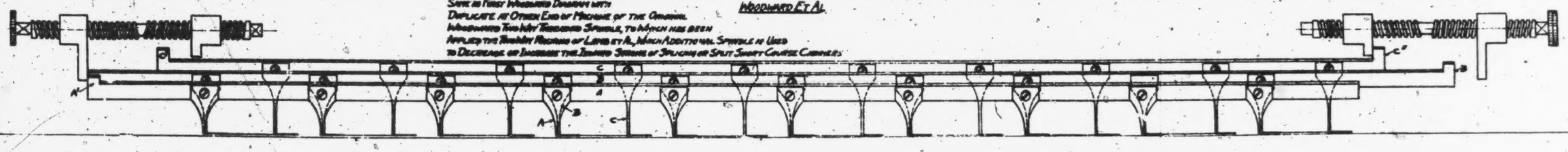
SAME AS PRECEDING WITH CENTER FIXED STOP FOR SPLICING OR SPLIT SHAFT COURSE CARRIERS.



9

WOODWARD ET AL

SAME AS FIRST MENTIONED DRAWING WITH DUPLICATE AT OTHER END OF MACHINE OF THE ORIGINAL MENTIONED TWO WAY THREADED SPINDLE, TO WHICH HAS BEEN APPLIED THE THREAD PICKING OF LEVER 81, WHICH ADDITIONAL SPINDLE IS USED TO DECREASE OR INCREASE THE TIMED STROKE OF SPLICING OR SPLIT SHAFT COURSE CARRIERS



DEFENDANT'S EXHIBIT H 1

855

Fig 1.

HERRINGBONE VERTICAL SPLIT-SATIN FIGURE

715

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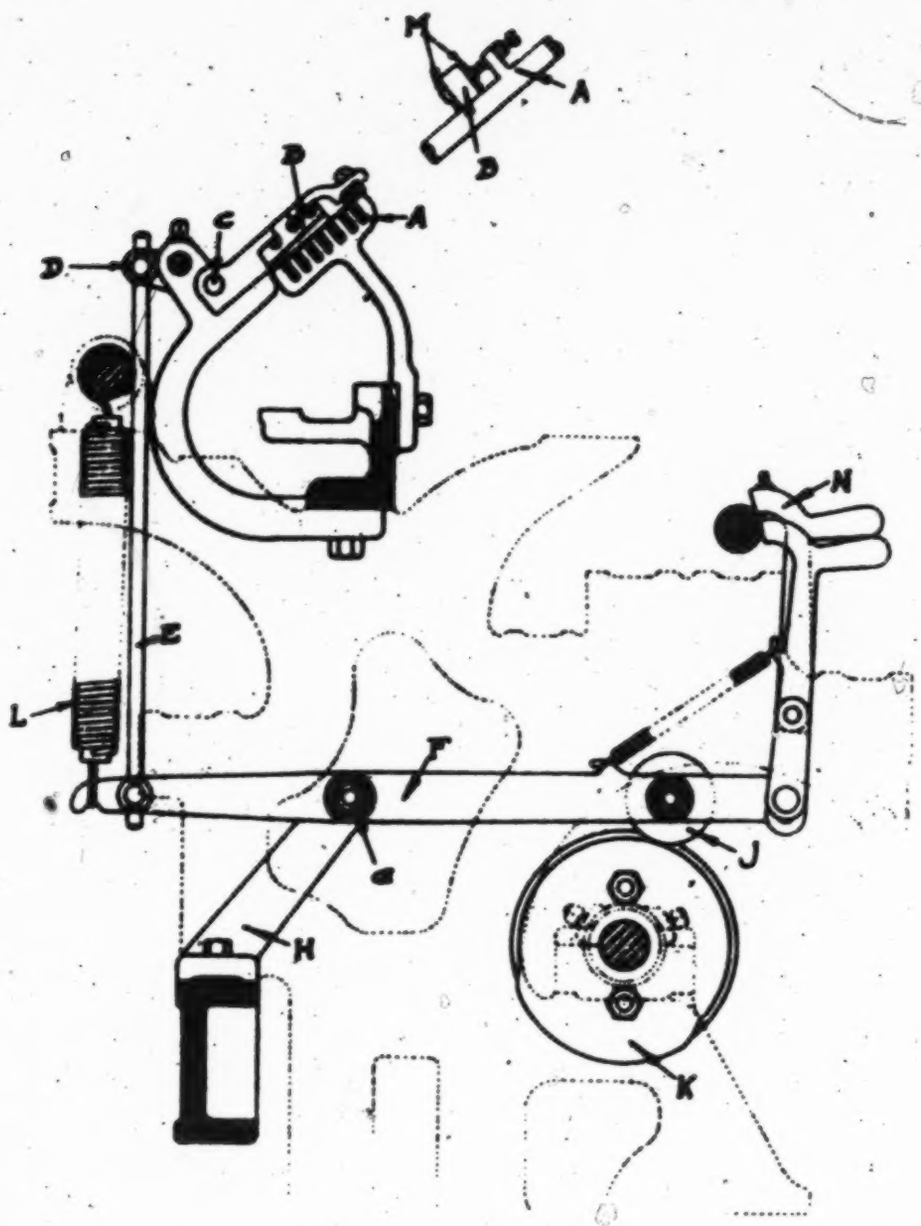
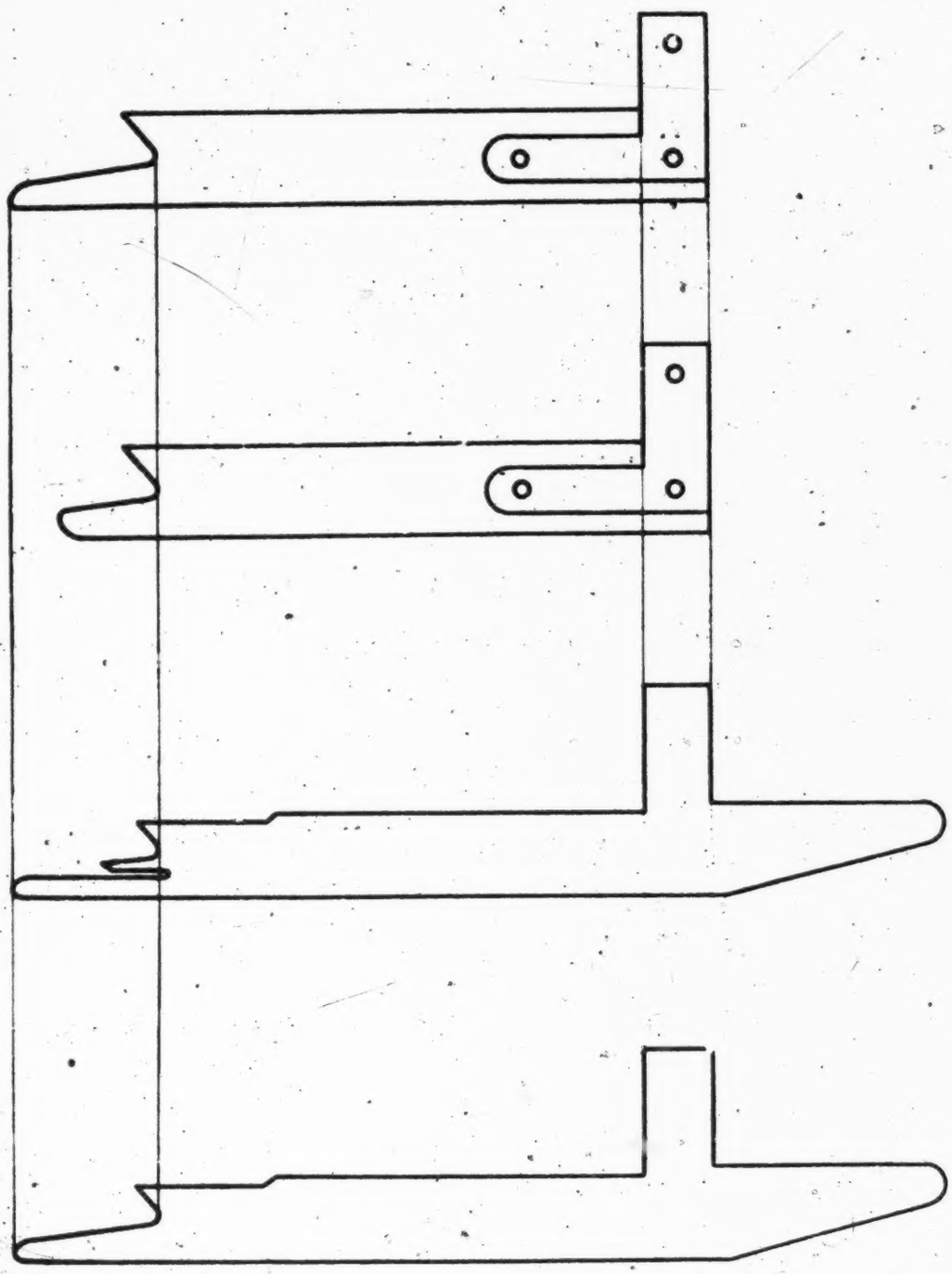
Fig 2.

REGULAR SPLIT YARN CARRIER STOP MECHANISM FILED ENDWISE.
HERRINGBONE—VERTICAL SPLIT SUTURE.



M.C. MILLER, M.E. APRIL 9, 1925.

FIG 3



HERRINGBONE — VERTICAL SPLIT — SUTURE SINKERS

MC MILLER, M.E. APRIL 1935

858

Def. Ex. 141 page 4.

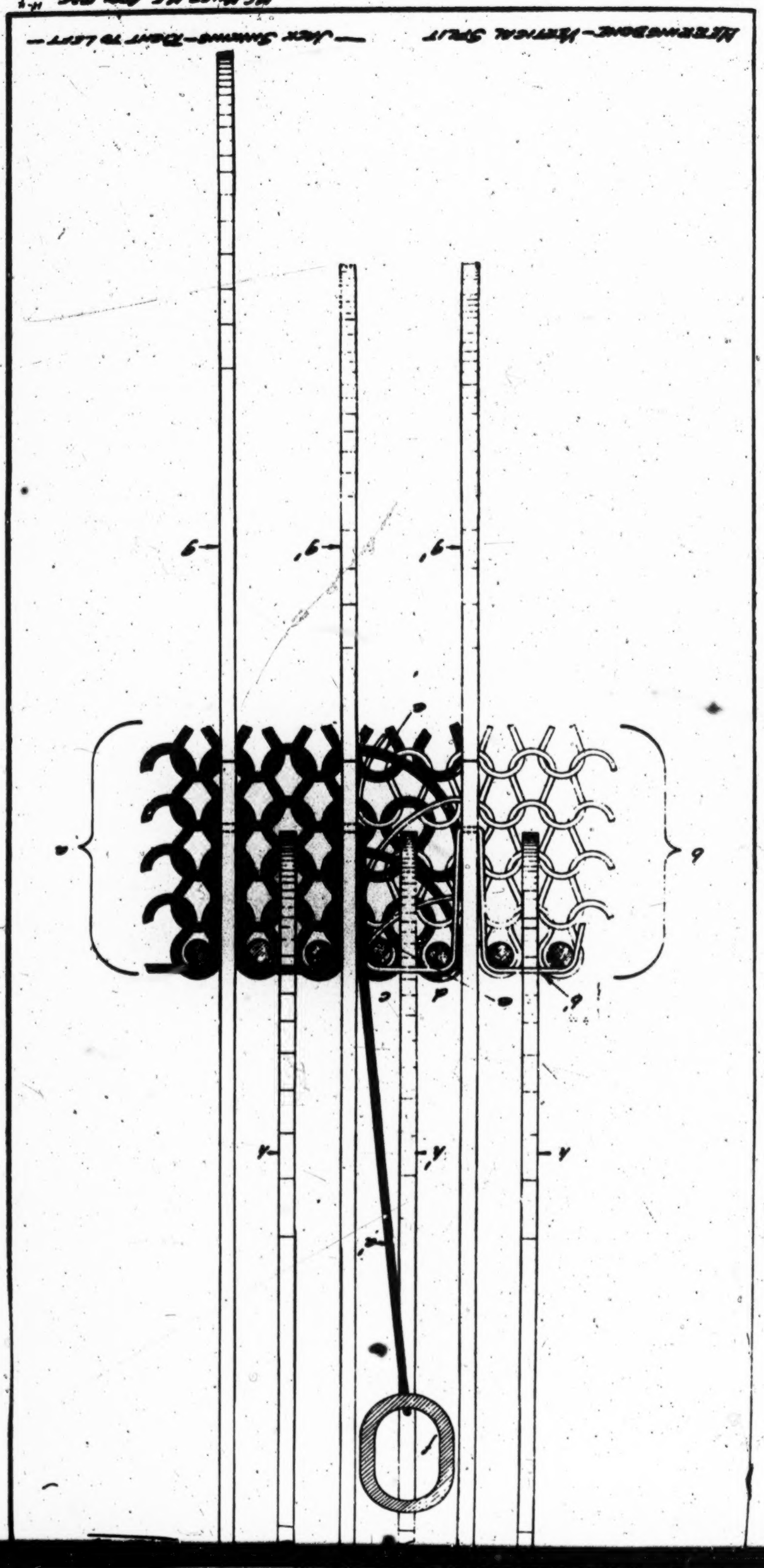
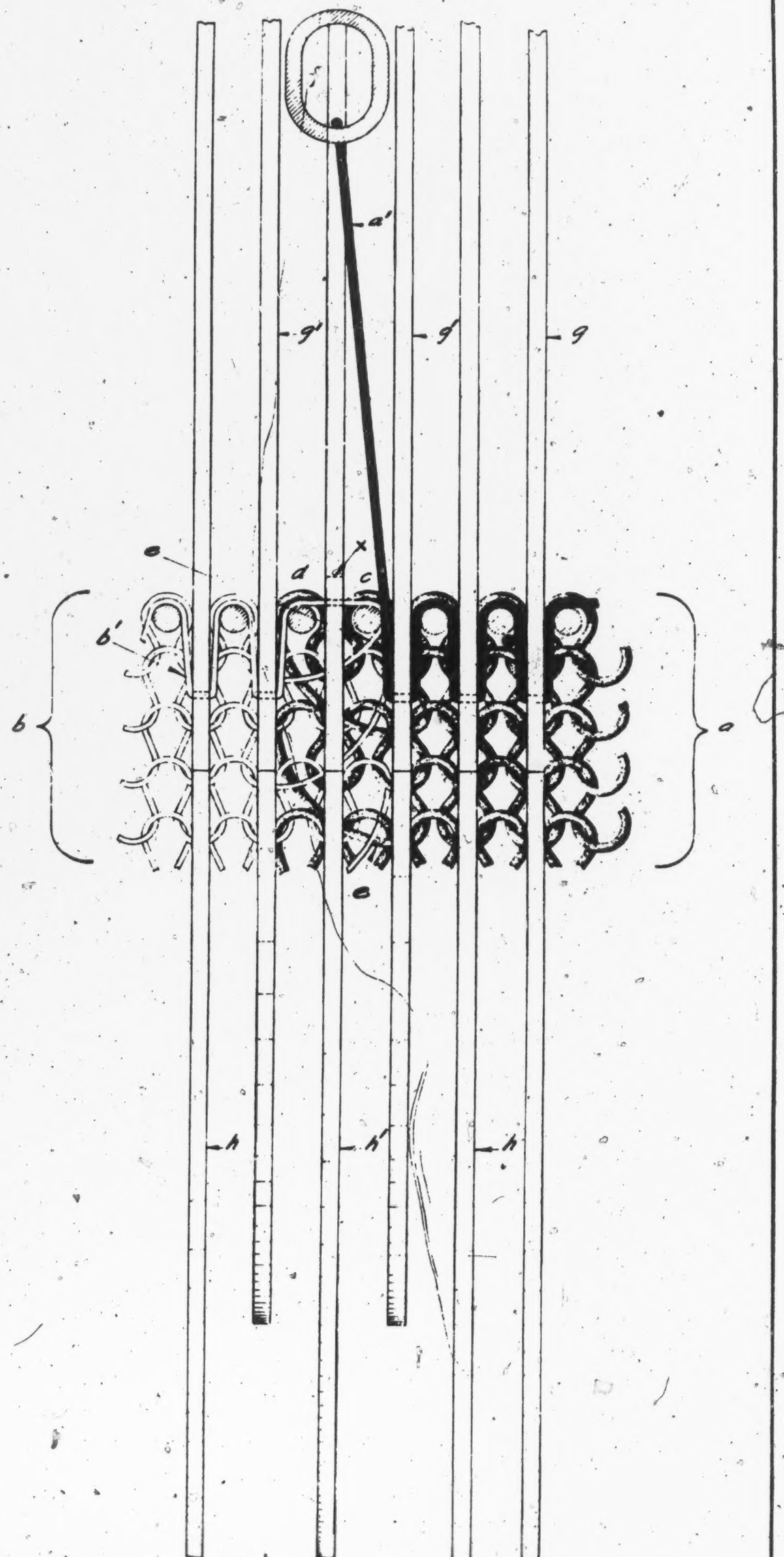


Fig 3



HERRING BONE—VERTICAL SPLIT DIVIDING — RIGHT TO LEFT —

M.C. MILLER, M.E. APRIL 1935. H'-3

860

Def. Ex. H-1 page 6.

MC MILLAR, ME APPL NOS

HERRINGBONE – VERTICAL SPLIT — SUTURE SHIFT-RIGHT TO LEFT

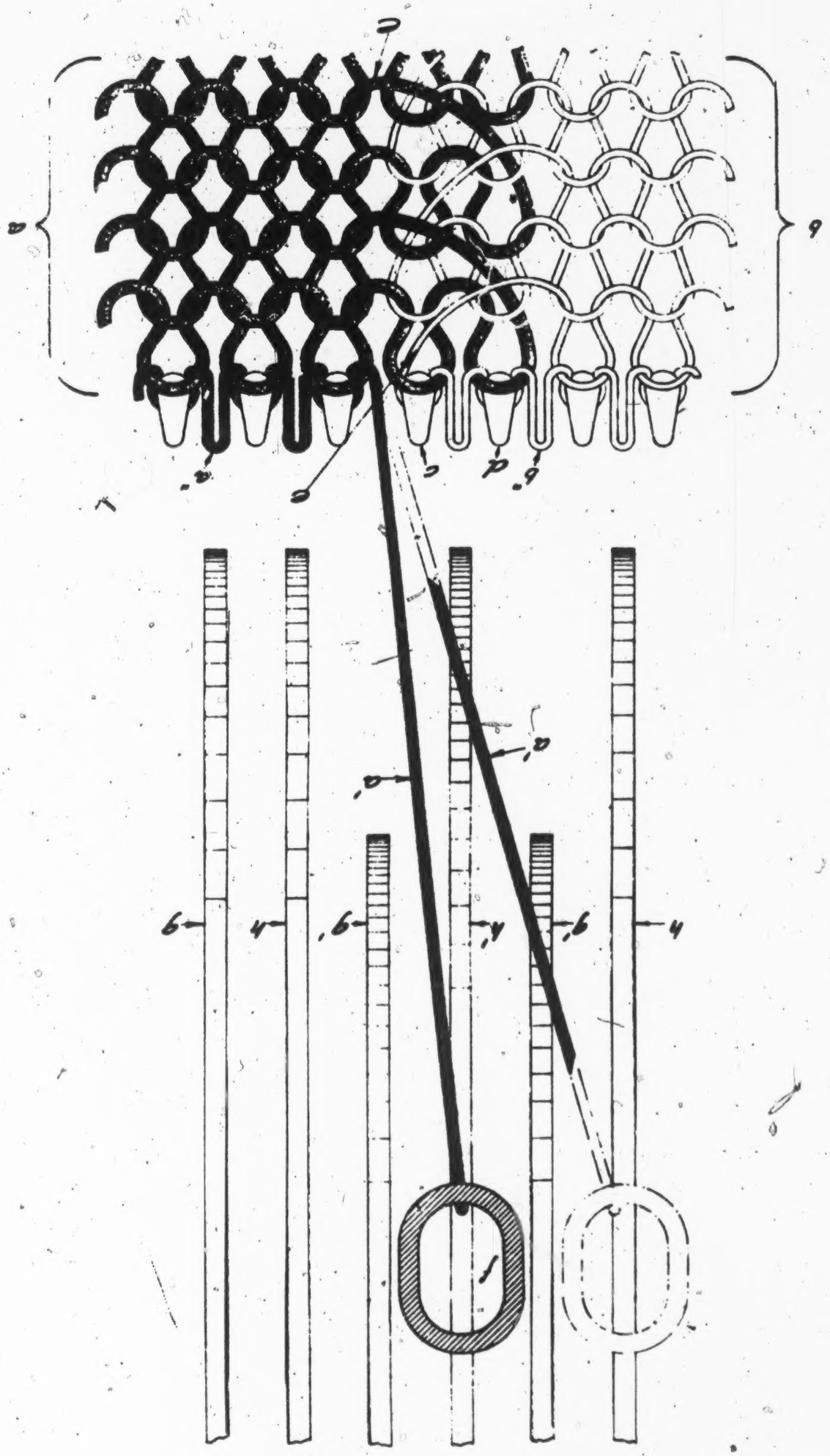


Fig 7

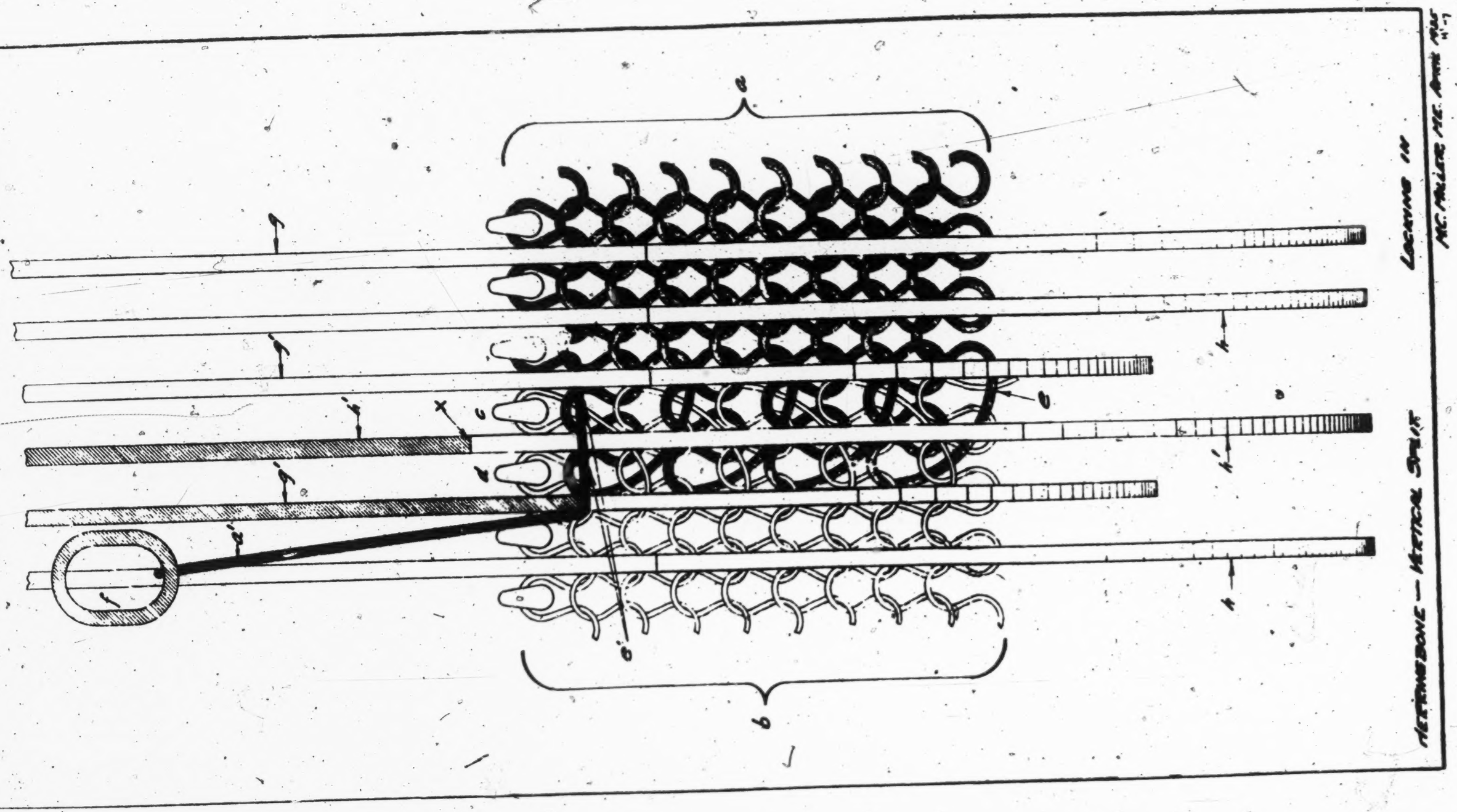
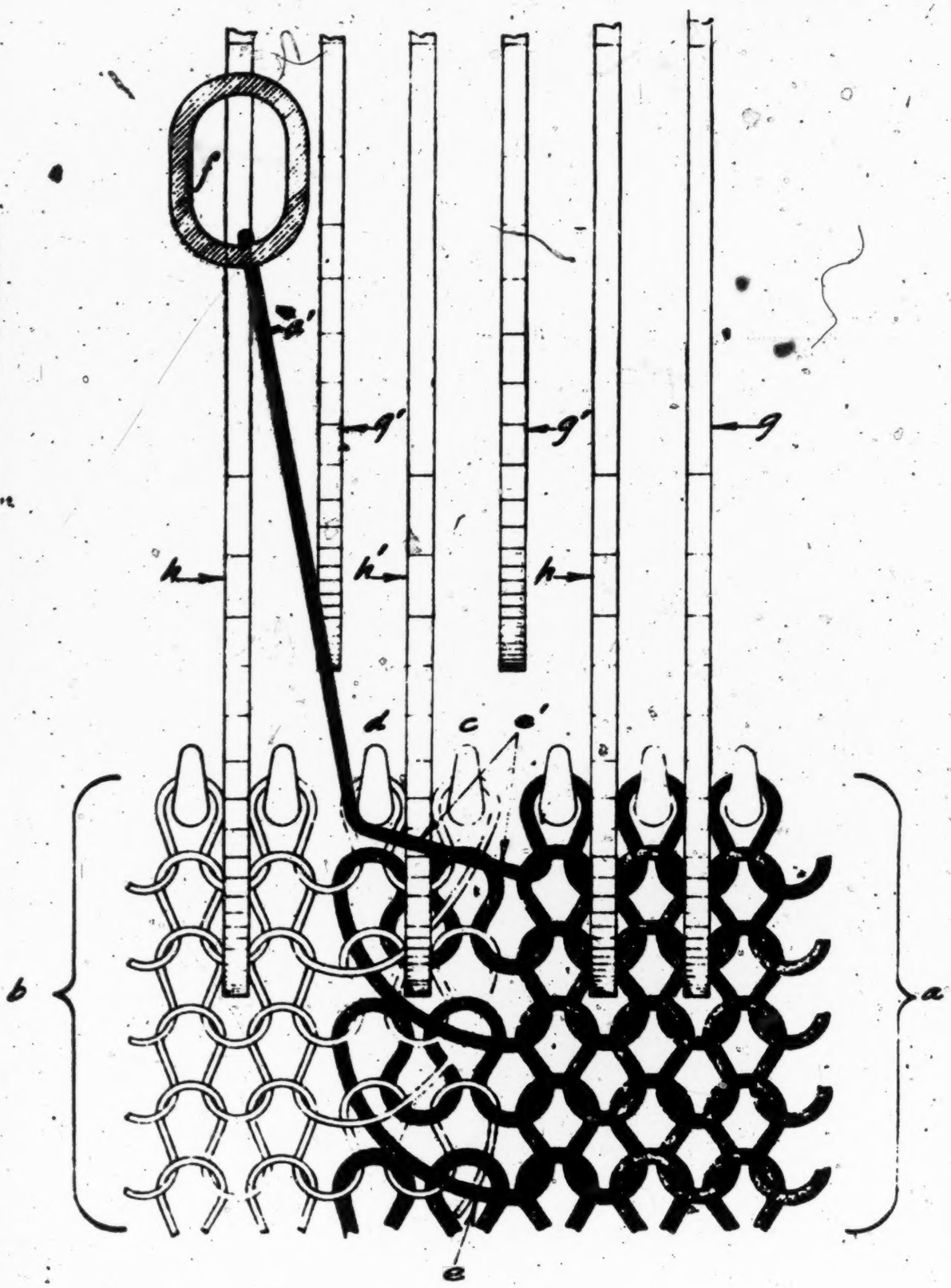

a
b
Location in
Pat. Pending Pat. Appl. Filed
Herringbone — Vertical Draft

Fig 8



HERRINGBONE—VERTICAL SPLIT

—PRIOR TO REVERSE TO RIGHT—

M.C. MILLER, ME. APRIL 1936

Fig 2

HERRING BONE-VERTICAL SPLIT — JACK SWING — 2 JACKS TO A SWING — U.S. NAVAL TORPEDO STATION, NEWPORT, R.I.

723

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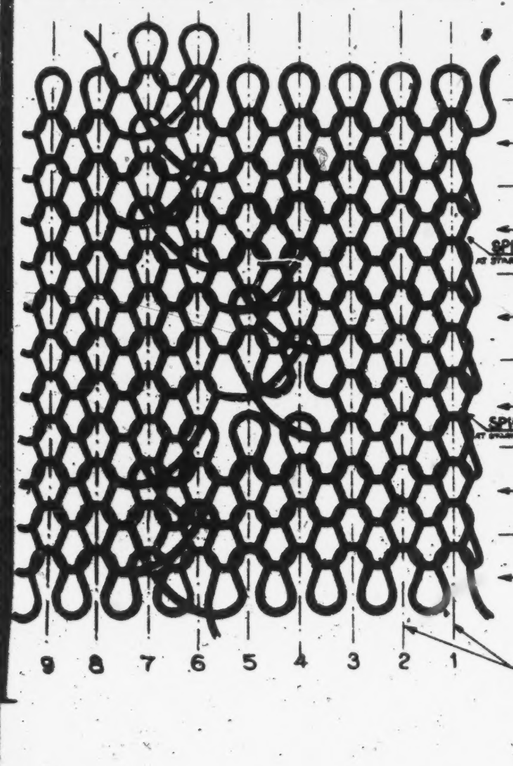
DEFENDANT'S EXHIBIT J 1

C-1

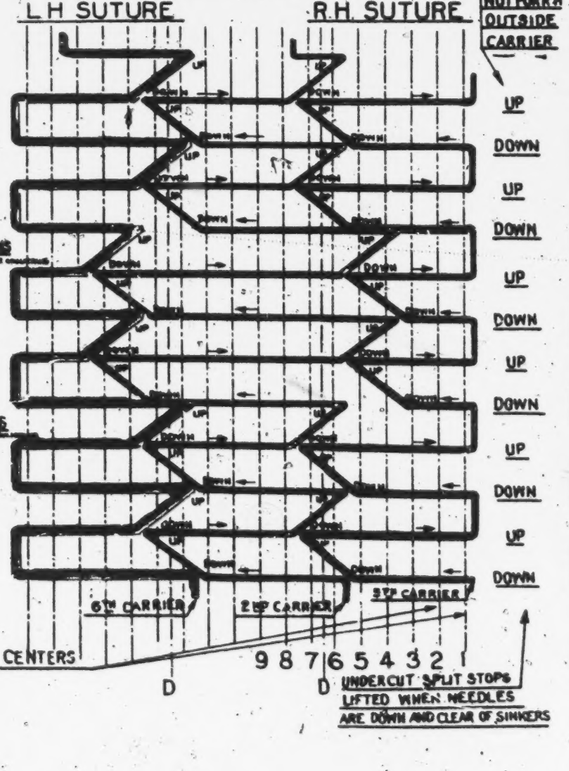
HERRINGBONE SPLIT

SCHLETTER PATENT Nº1.713.628

FABRIC SHOWING R.H. SUTURE



YARN LAYING DIAGRAM

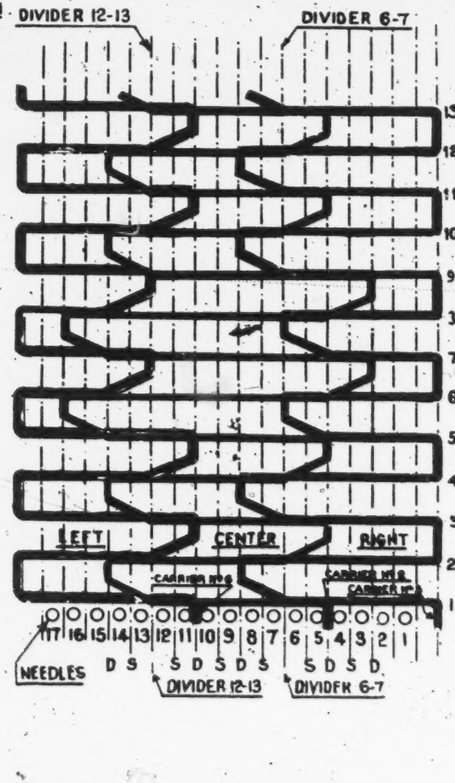


C-1A

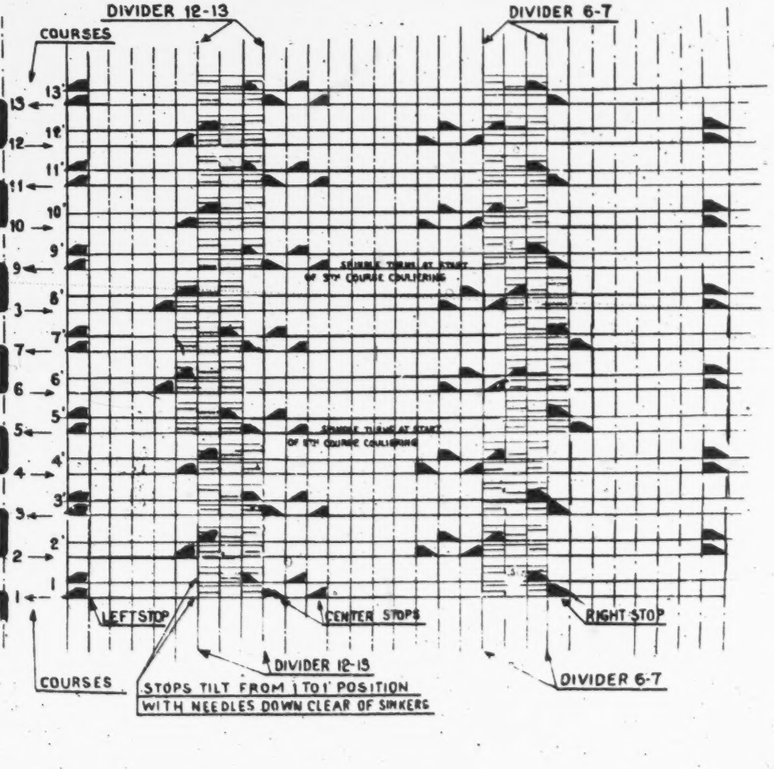
HERRINGBONE SPLIT

SCHLETTER PATENT Nº1.712.628 Dep. Ex. J1 668-Ct

CARRIER MOVEMENT DIAGRAM



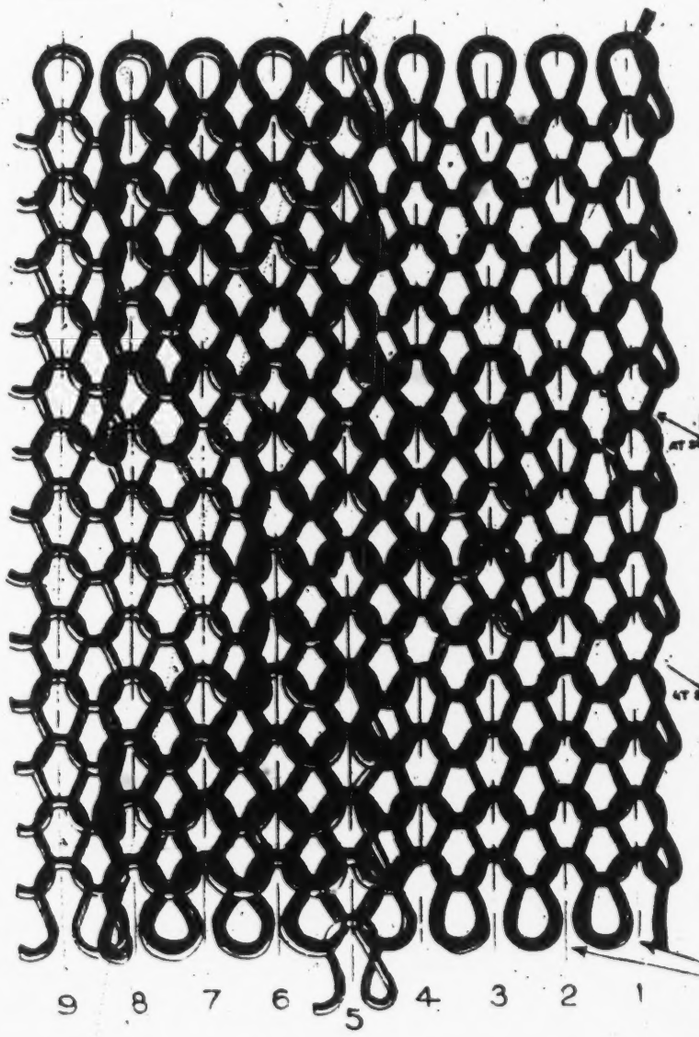
SPINDLE AND CARRIER STOP DIAGRAM



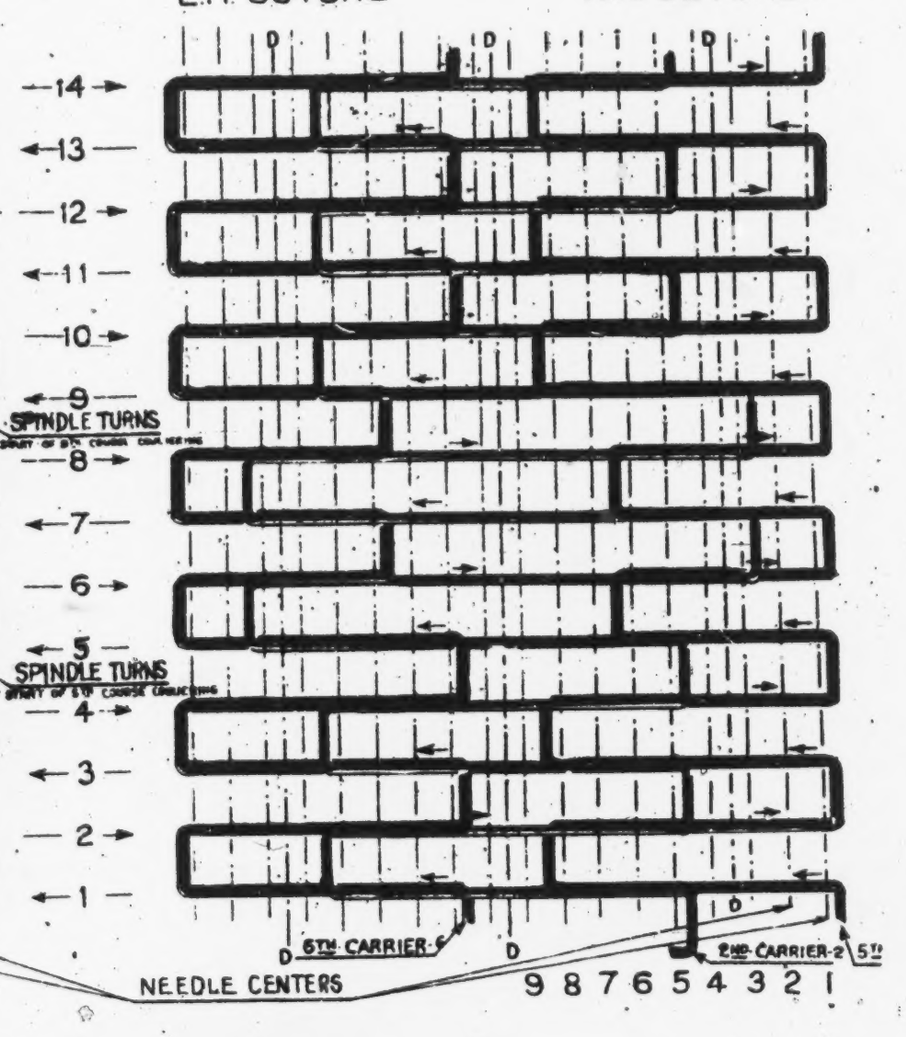
FOUR NEEDLE LAP SPLIT

B-1

FABRIC. SHOWING R.H. SUTURE



YARN LAYING DIAGRAM



[redacted]

Page Tightly Bound

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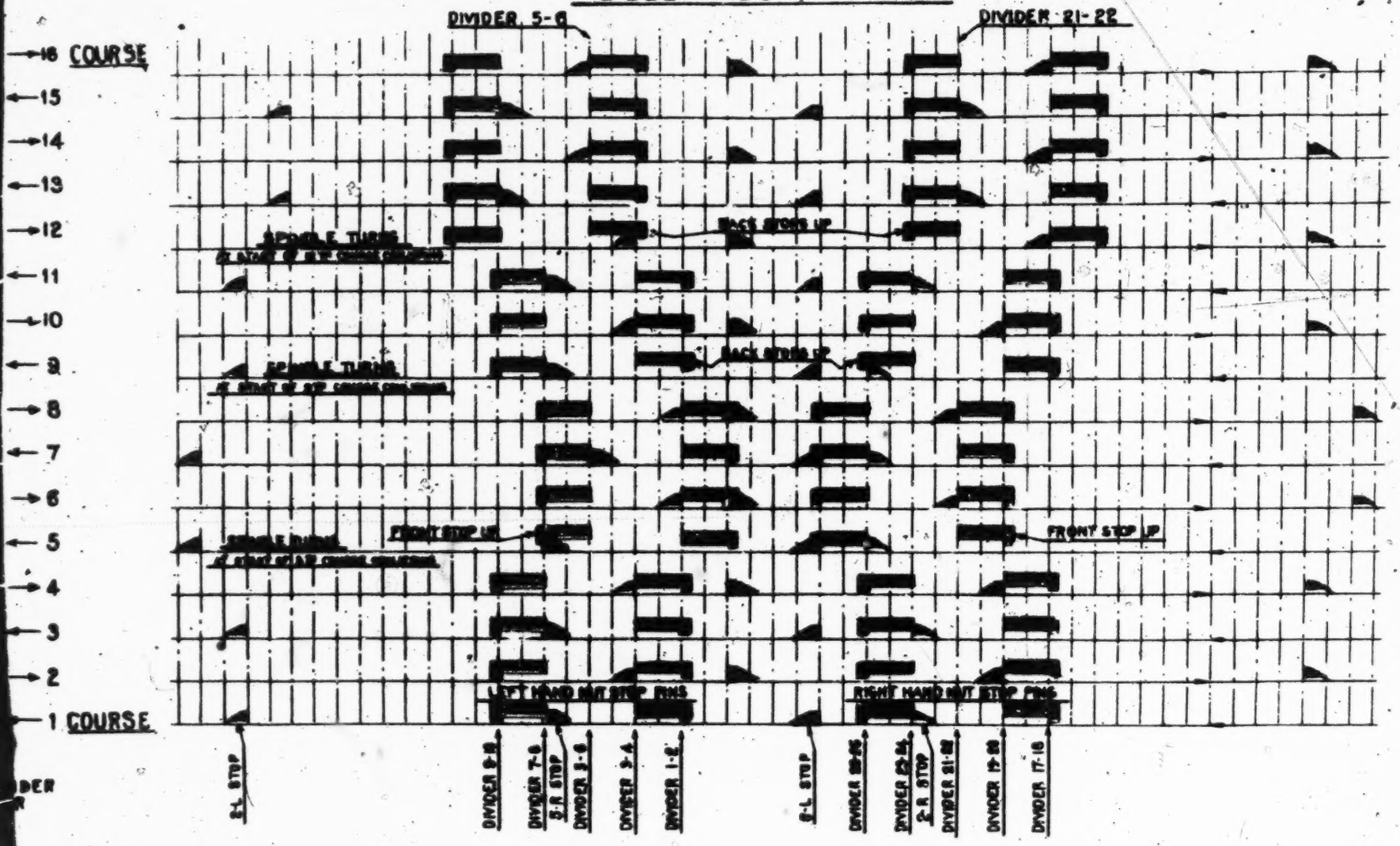
DEFENDANT'S EXHIBIT 01

A-1A

SPINDLE STOP AND CARRIER STOP DIAGRAM

A-1B

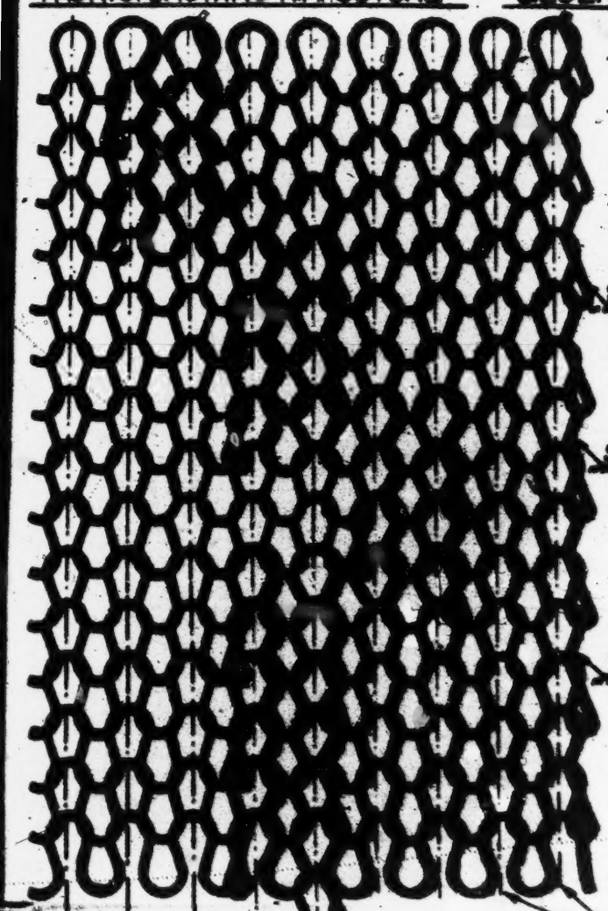
LIEBERKNECHT SUTURE



TWO NEEDLE LAP SPLIT

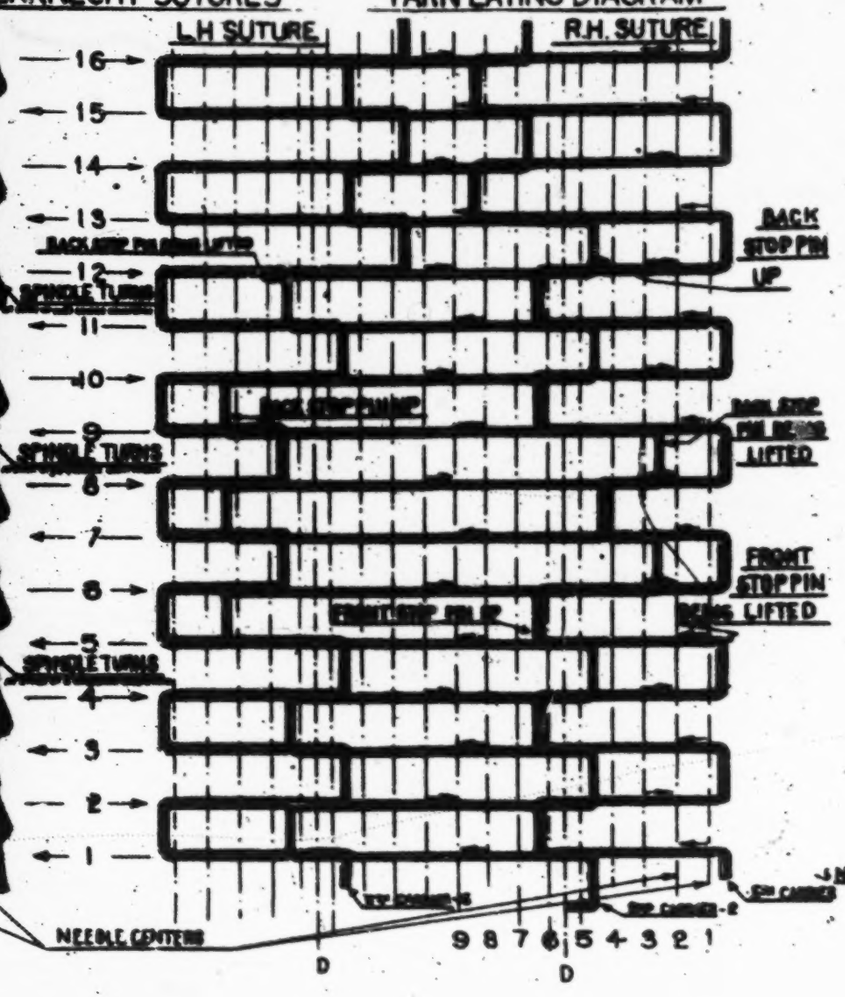
A-1

FABRIC SHOWING R.H. SUTURE



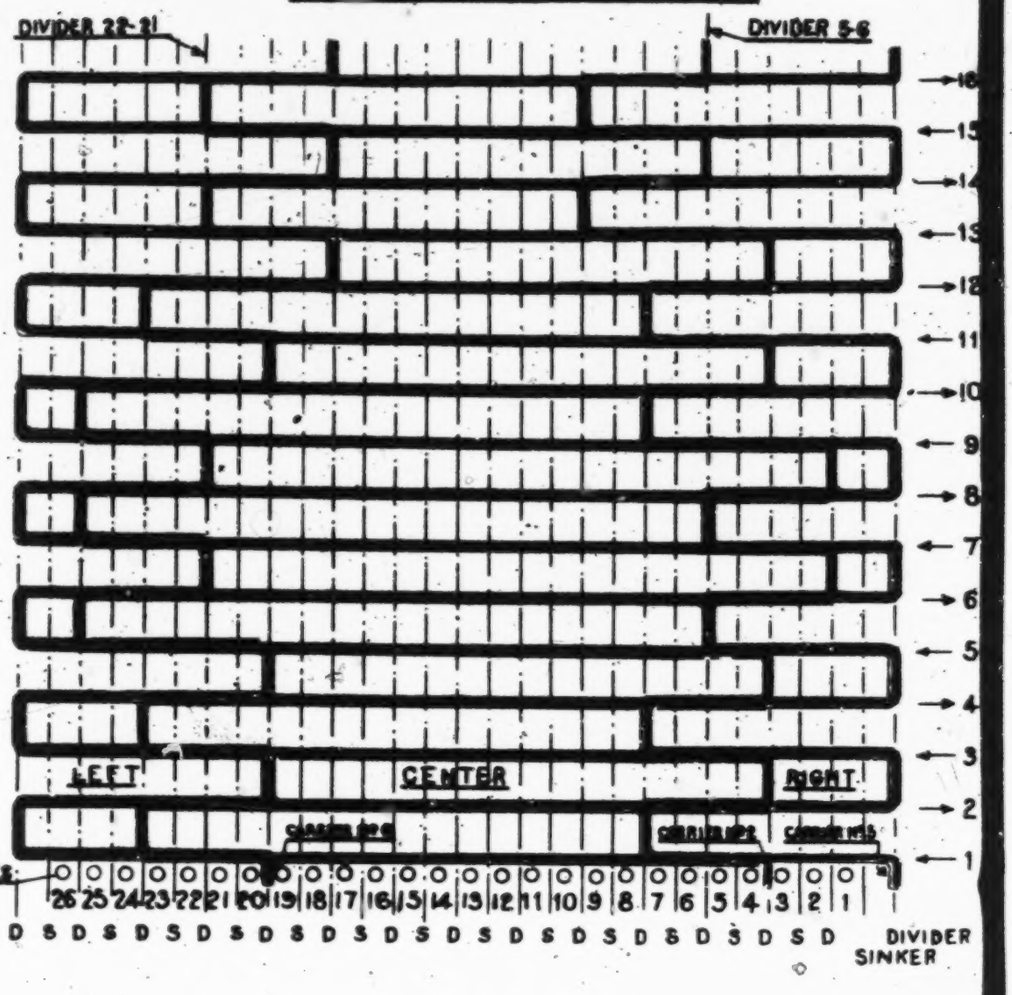
LIEBERKNECHT SUTURES

YARN LAYING DIAGRAM



CARRIER MOVEMENT DIAGRAM

LIEBERKNECHT SUTURE



[fol. 867] DEFENDANT'S EXHIBIT C-2

Translation

Louis Hirsch, Inc., 556 Gregory Avenue, Weehawken, N. J.

October 24, 1927.

Order No. 774

To Karl Lieberknecht, Oberlungwitz, Sa.
Ship directly to Philadelphia.
Delivery: as soon as possible.

7 —Special Pointed Heel Attachments for variable width reinforcing designs, like sketch. to widen and narrow over two needles.
Rocker should also be for widening and narrowing.
For Leggers No. 5278, 5207, 5400, 5517, 5534, 5518, 5121.
Customer: Minisac Mills, Inc.,

729

868

DEFENDANT'S EXHIBIT D 2

LOUIS HIRSCH, INC.

KNITTING MACHINERY AND ACCESSORIES

556 GREGORY AVENUE

WEEHAWKEN, N. J.

March 12, 1928.

EPHONE, UNION 502

NEW YORK OFFICE
28 BROADWAY
WISCONSIN 3230-1

UR ORDER NO.

PARTMENT

R ORDER NO

PPED VIA

RMS

SOLD TO Rosedale Knitting Co. Inc.,
Reading, Pa.

ADDRESS

SS NEW YORK - Arrived in New York on 3/12/28

As per Specification "D" - Order Copy dated 9/11/26.

MACHINE NO. 5831
CASES KL 3431/33

1 KARL LIEBERKNECHT FULL FASHIONED HOSIERY MACHINE
Model 1927 - High Speed Type

Legger, 42 gauge, 24 sections at 14" each,
7 threadcarriers, with attachments for:

Split
Plating
Movable knocking-over bits
Jack spring bars
Shock absorbers
and accessories - - - - - - - - - - - - - $8250.00

Split Attachment for making spliced
high heels with narrowing and
widening, also split re-inforced
selvage - - - - - - - - - - - - - - - - - 1125.00

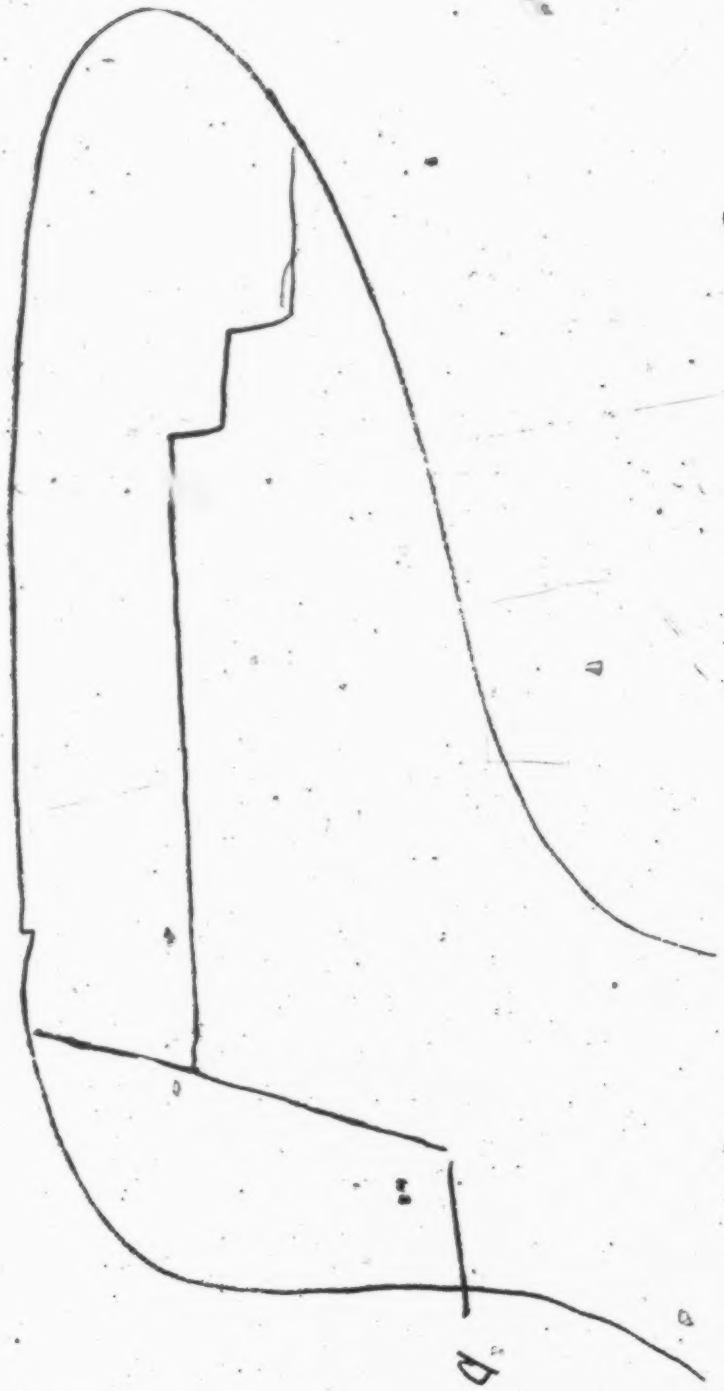
$9375.00

Page Tightly Bound

730

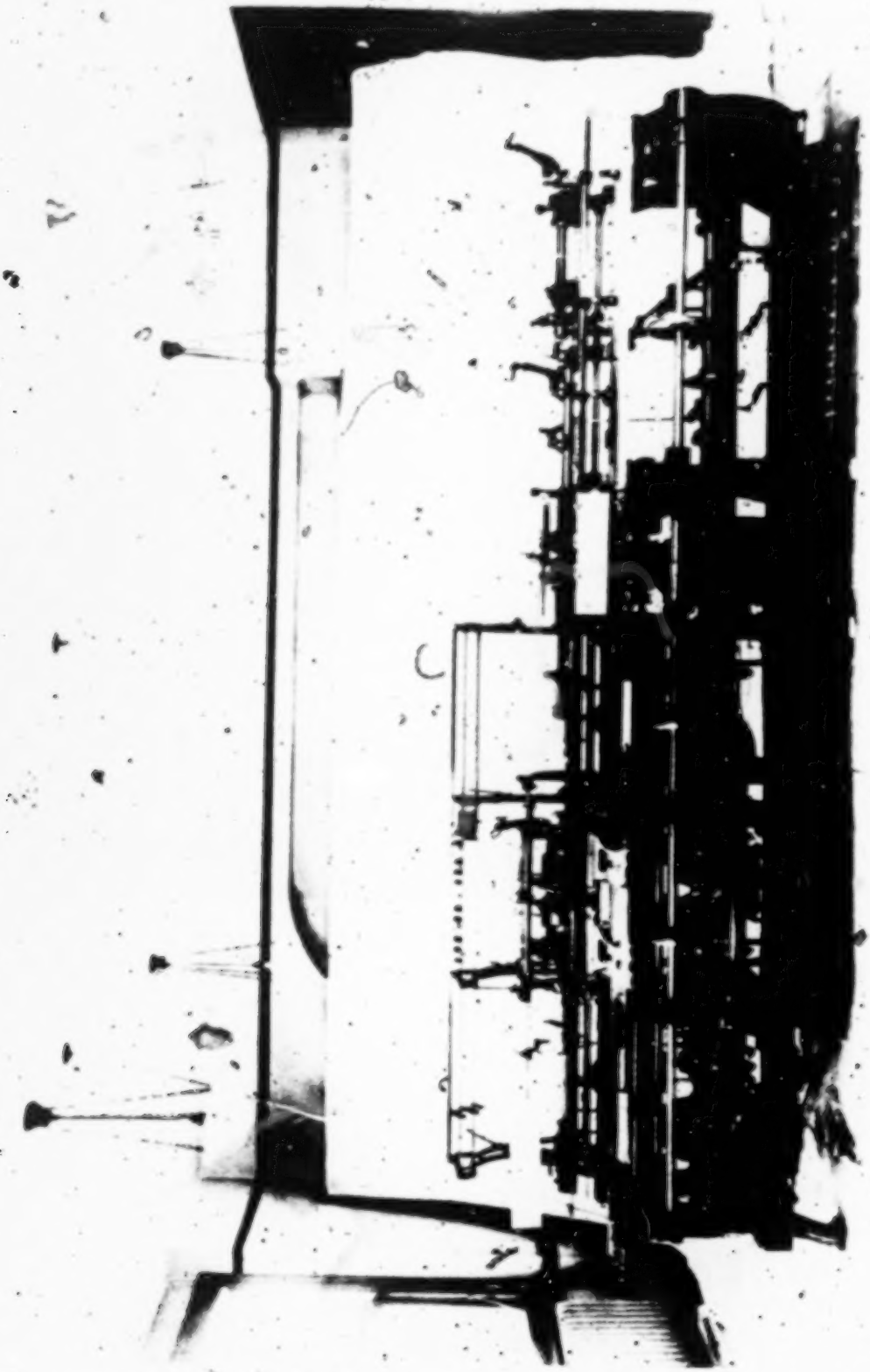
869

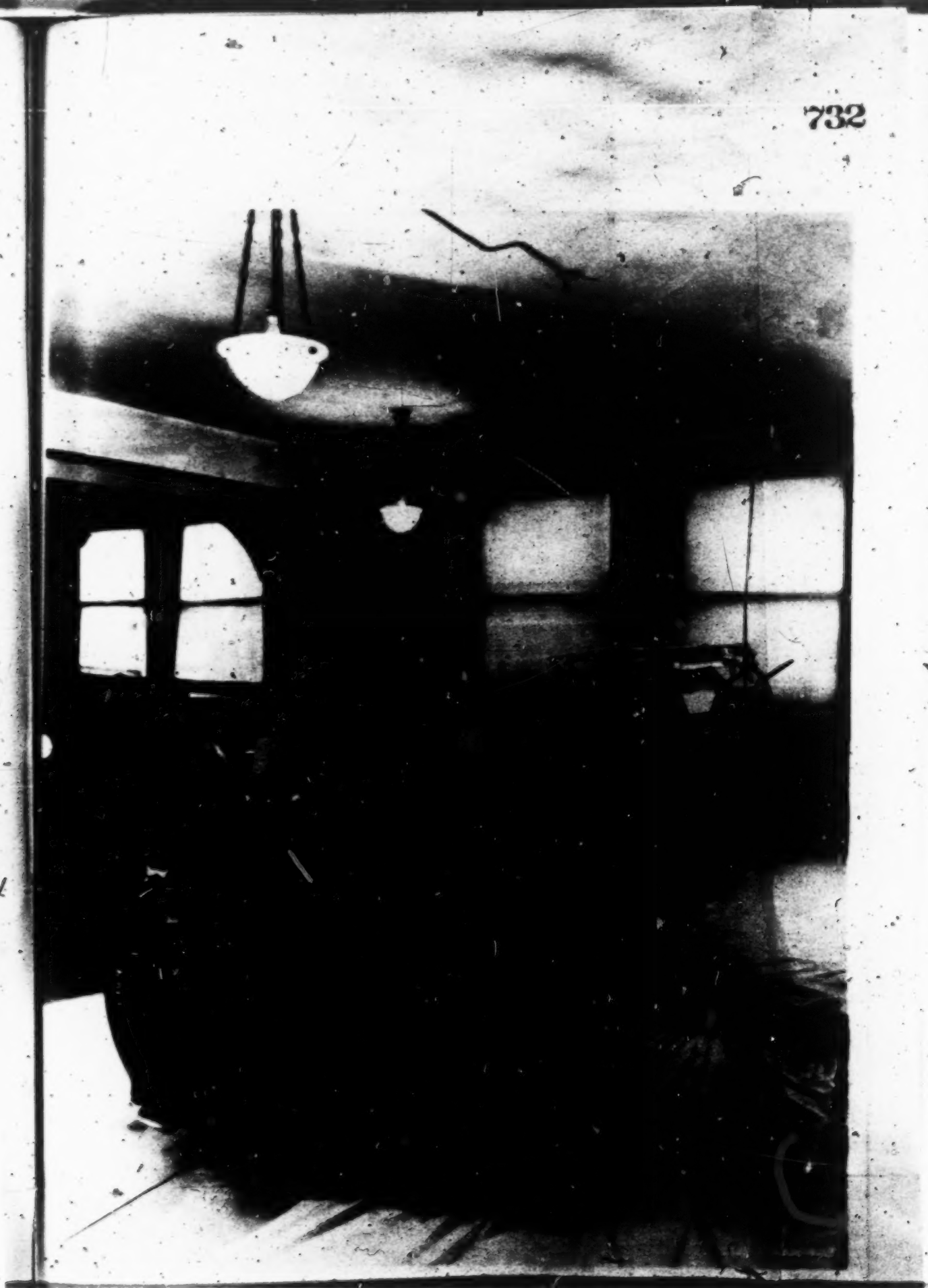
DEFENDANT'S EXHIBIT F 2

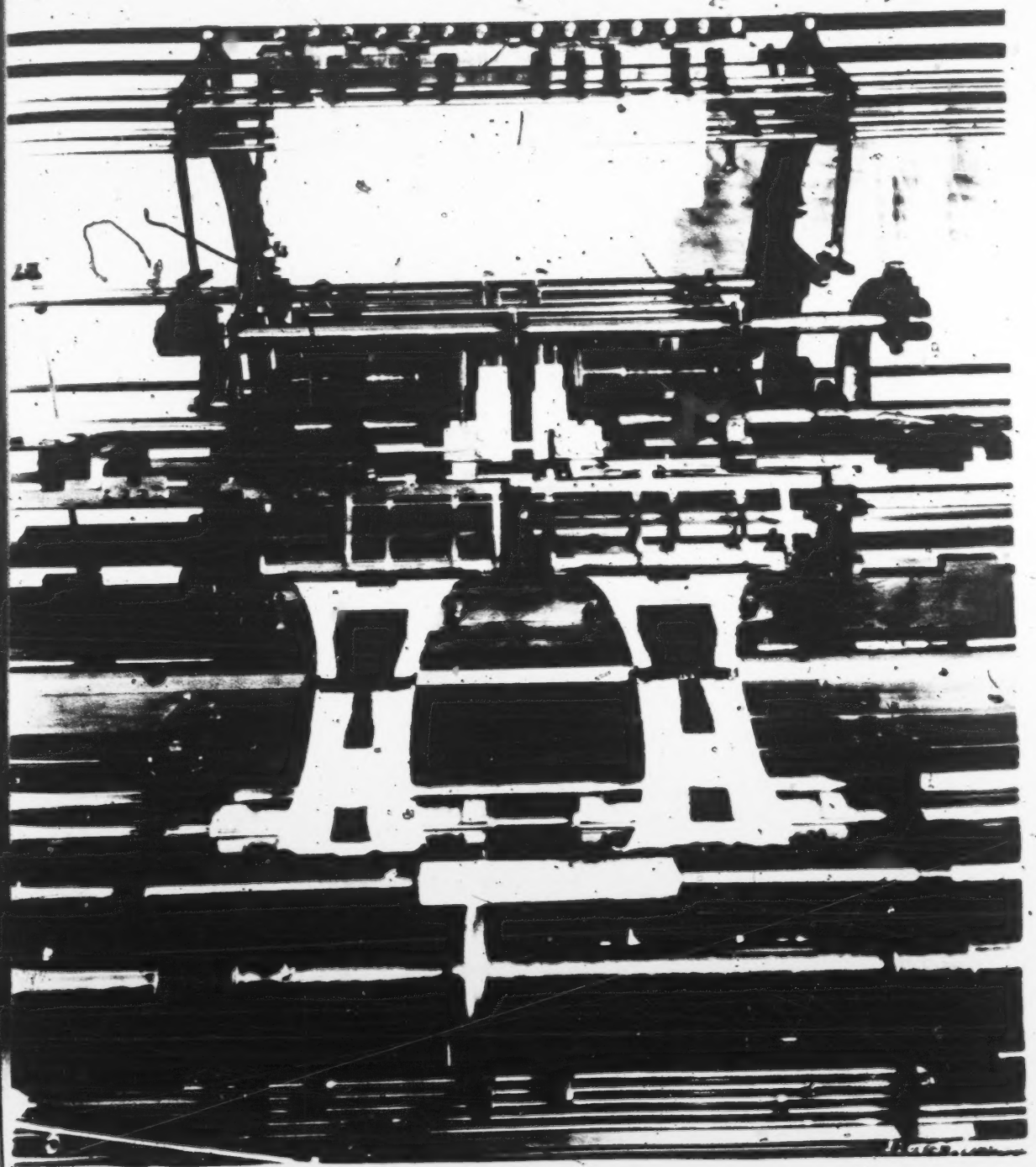


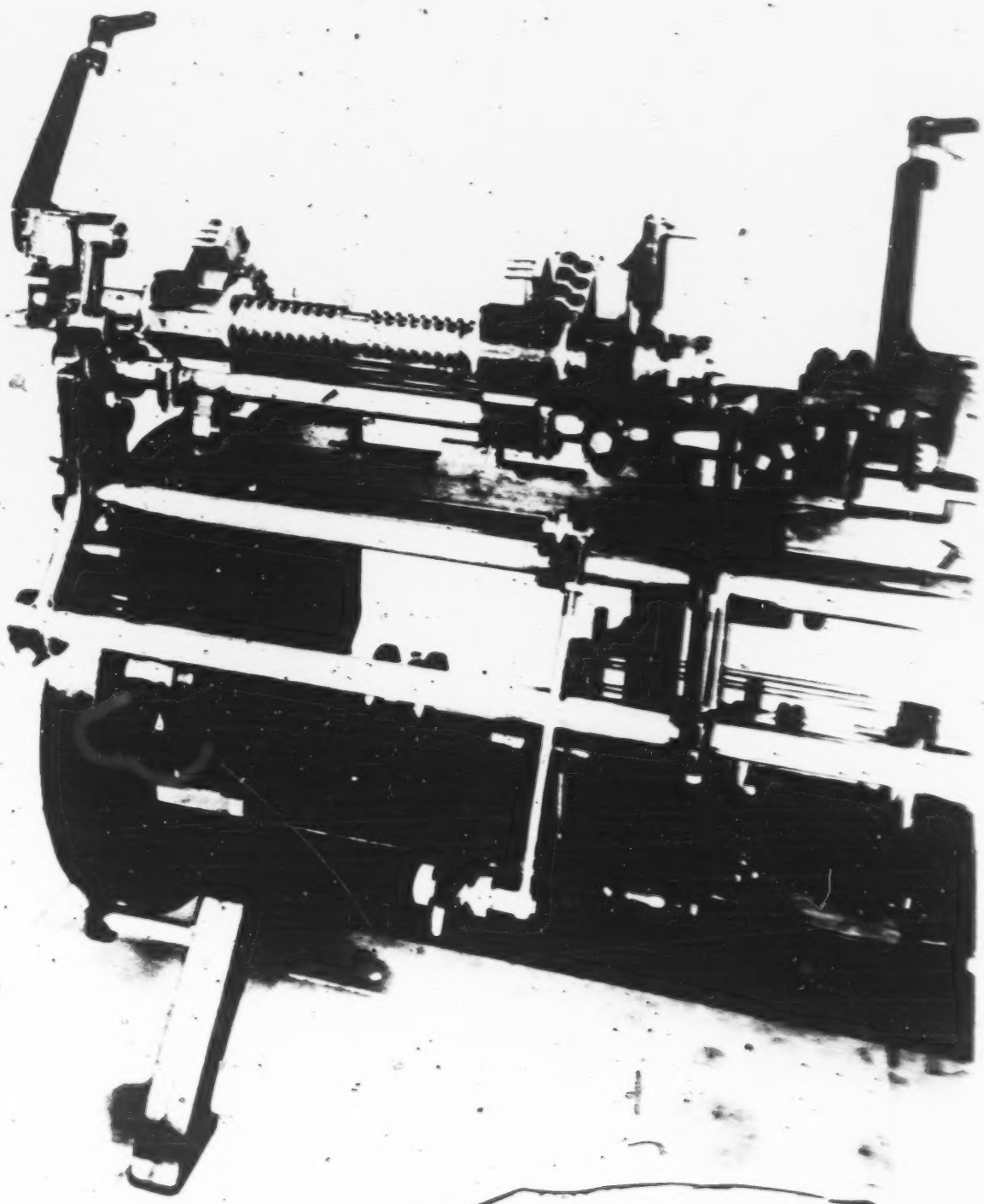
[Vols. 870-875]

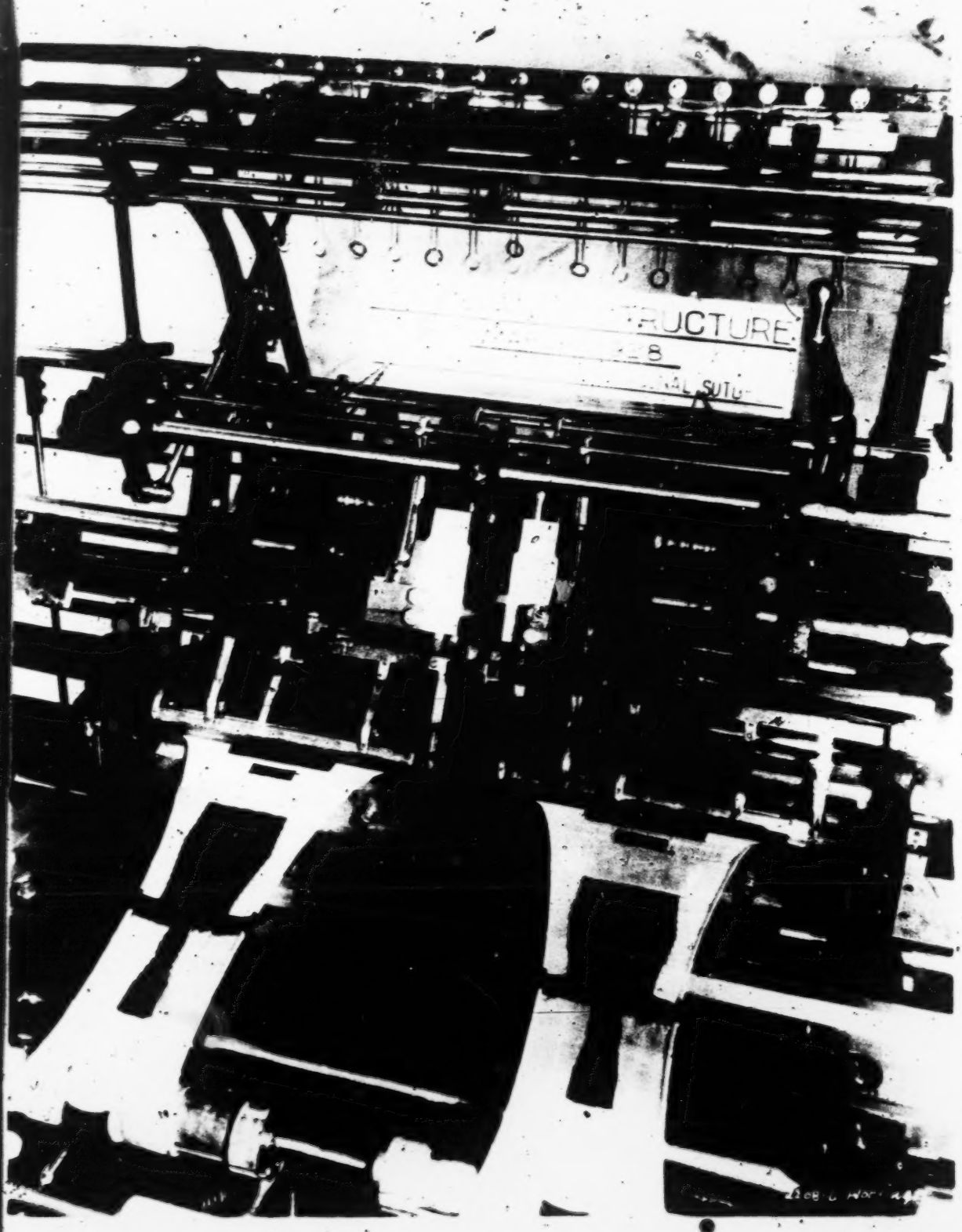
DEFENDANT'S EXHIBIT L-2










RUCTURE
8

[fols. 876-877] IN UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF NEW YORK

In Equity. No. 63-32

TEXTILE MACHINE WORKS, Plaintiff,

vs.

LOUIS HIRSCH TEXTILE MACHINES, INC., Defendant

OPINION, LINDLEY, D. J.

Plaintiff, manufacturer of full-fashioned hosiery knitting machines, brings this suit for infringement of Claims 1, 3, 14 and 15 of patent No. 1,713,628 issued May 21, 1929, to Schletter. Defendant, the American sales representative of a German manufacturer of knitting machines, sells the latter in America and manufactures and sells in America the specific attachments charged to infringe. Defendant denies validity and infringement. The patent in suit was held valid and infringed in Textile Machine Works vs. Hofmann, by Judge Avis in 4 Fed. Sup. 837, affirmed in 71 Fed. (2d) 973 (C. C. A. 3). The Supreme Court denied certiorari.

The patent in suit covers an attachment to be applied to a flat knitting machine of the Cotton type for making full-fashioned hosiery. Such a machine is complete in itself and is old in the art. The device of the patent, when added to the regular parts of such a knitting machine previously installed and in use, or furnished as part of the equipment of new machines. The "Cotton" machine manu- [fol. 878] factures full-fashioned hosiery and is distinguished from other old machines, of such types as circular and independent needle machines and others similarly designed primarily for the making of underwear.

The patent drawing illustrates only certain sections of the frame members of a knitting machine, but the specifications, description and claims indicate clearly that the patented device is to be attached to a complete, operable "Cotton" machine. In order to arrive at a correct understanding of the issues, some discussion of the Cotton machine is advisable. A typical example of such a machine shows sections for knitting 24 stocking legs at one time, the operations upon one section being duplicated simultaneously on all the others. There are some 12,000 needles.

All movement originates from and is controlled by one cam shaft. To add an attachment, performing additional functions requiring automatic operation, involves the location of additional power devices on the single cam shaft and raises the problem of synchronization of the attachment with other moving parts of the machine and avoidance of interference therewith.

Operating parts of the knitting machine include needles, sinkers, guides, carrier bars, stops and numerous other mechanical parts, all cooperating in a complete automatic machine. The yarn guides are mounted on reciprocatory carrier bars, running lengthwise of the machine, each bar carrying one guide for each knitting section. The total reciprocating movement of the bar is the width approximately, of a single section, so that the yarn guide may [fol. 879] be caused to traverse the entire width of the section and put into position the yarn to be utilized by the needles of that section in the knitting operation. Such reciprocation is accomplished by mechanism operated from the main cam shaft.

The limitation upon the lateral movement of the bars is automatically controlled by the end stops, which can be adjusted, automatically in order to change the stroke of the carrier bars, in one direction only. This operation is referred to because it is required in fashioning, or, otherwise speaking, the "narrowing" of the stocking to produce one approximately the shape of the human leg. "Narrowing" involves not only the adjustment of the end stops gradually to shorten the stroke of the carrier bars with their yarn guides, but also the operation of elements known as narrowing points, which pick up some of the outer loops of the fabric from their needles and transfer them to inner needles, thus "narrowing" the fabric. These narrowing points move both horizontally and vertically, the vertical movement being produced by slides, controlled by pawl and ratchet mechanism, operated from the main cam shaft.

Though there is in the machine a reversely-threaded spindle, which moves the slides, causing a vertical movement from side to side, this spindle should not be confused with one similarly described, constituting a part of the device of the patent in suit. The latter carries stops for controlling the reciprocatory movement of the carrier bars by cooperation with abutments placed at suitable positions.

Narrowing involves another operation, namely, the adjustment of the end stops to shorten the throw of the yarn guide [fol. 880] carrier bars. Further detailed description is not essential; but it is to be observed that the narrowing mechanism is a unit which constitutes a part of the old machine and that when the narrowing operation is completed the end stops and the slides are returned to their initial positions by the turning of the spindle by hand in a direction opposite to that in which they rotate in the narrowing operation. This is termed "racking-out".

The Cotton machine includes leggers and footers. It has as one of its attachments the so-called split sole attachment. It has long been in common use in making split-seams, and this function is referred to in the patent as being well known.

Schletter's attachment is a device to be added to the machine we have been discussing and intended to make possible other and additional results. Its essential parts are the reversely-threaded spindle, stops mounted thereon capable of being moved toward and from each other by rotation of the spindle in opposite directions. Ratchets are provided at the end of the spindle, adapted to turn the same in one direction or the other. With mechanical connection, it is possible to operate the ratchets by power from the main cam shaft. There is included a mechanism for determining which of the ratchets is to be operated, which in turn determines the direction of rotation of the spindle. There are two pattern chains, one of which determines the time of operation of the spindle, and the other, the direction of rotation. The means for operating the [fol. 881] ratchets, which need not be discussed fully, is mentioned in the patent as "pattern controlled means for determining the time of operation of the spindle." The mechanism for determining which of the pawls will engage the ratchet is described by the patentee as "pattern controlled means for determining the direction of rotation of the spindle." The stops shown in the device are a well known form of split-seam stop, having an undercut portion and capable of being oscillated, when an open or so-called "herring-bone" seam is to be formed. The claims relied upon are not directed to the specific form of stops shown, nor to split-seam stops as distinguished from splicing stops nor do the claims call for oscillating stops or include the

oscillating means as a part of the invention. The patentee expressly states that his concept is not limited to the use of these specific stops for this specific purpose.

I have mentioned some of the elements of the mechanism without attempting to create a mental picture of the combination. This I do not deem essential, in view of the record, which will be submitted to the court of review.

As pointed out, the device is intended to cooperate with a full-fashioned machine, to which it is attached; and its function is to provide means for fashioning such designs as clocks upon full-fashioned stockings, doing both reinforcing or splicing work and split seam work. This purpose, the patentee said, his device accomplished by an action, whereby "yarn-guides" can be accurately controlled to lay a yarn over a distance less than the full length of a [fol. 882] course being knitted, as for reinforcing or for so-called split-seam work, wherein sections of fabric are connected by suture seams. For this purpose I preferably employ opposed stops with conjoint controlling means, arranged to move them toward or from each incrementally, but any equivalent means or devices may be employed which will effect the purpose of the invention."

In the ordinary operation of the knitting machine, the yarn guides are controlled only by the end stops and lay the yarn over the full width of the fabric being knitted, that is, from selvage to selvage. In contrast, Schletter's purpose was to furnish accurate control for yarn guides which lay the yarn over a distance less than the full width of the fabric or less than the full length of the course being knitted. This section produces "reinforcing" or split-seam work. Reinforcing is the knitting of additional thread over a particular area of the main body of the fabric, producing in such area a double thickness. Splicing, as used by the patentee, refers to the same operation. "Split-seam work," according to the patentee, means inserting in the body of the stocking an area formed by separate thread or fabric, as distinguished from a reinforced area, involving a separate thread knitted in to reinforce the main body of the fabric. The two types of work are commonly known as reinforced or splicing and as split-seam or insert work.

In practical operation, certain of the carrier bars travel the full course of the fabric being knitted and are controlled by the end stops. When a clock is inserted, the carrier bar laying the thread for the insert is controlled by auxiliary

[fol. 883] stops, an abutment on the bar contacting at each end of the auxiliary stops with the inner face of one of the same. Simultaneously, other carrier bars for laying the thread on either side of the insert are controlled by the end stops at one end of their throw and by the auxiliary stops at the other, an abutment on the carrier bar striking against the end stops at one end of its route and on the outer side of one of the auxiliary stops at the inner end. During the knitting of the inserted portion, the position of the stop is adjusted automatically by the turning of the spindle to form a junction along zigzag lines inclined to the wales and courses of the web.

In making the reinforced or spliced clock, the thread forming the main body of the fabric is laid by yarn guides on carrier bars having the full stroke and controlled by the end stops. The thread for the reinforcement is laid by guides on other carrier bars, traveling less than the full width of the fabric and controlled by the auxiliary stops, which cooperate with abutments properly placed on the carrier bars.

These two operations are specifically referred to in the patent, but there is another type of operation properly referred to as selvage reinforcement, that is, reinforcing work commencing at the edge or selvage of the fabric and running in therefrom. As contrasted with insert and reinforced work, in areas removed from the edges, in selvage reinforcement, while the main yarn guide carrier bars are controlled by the end stops, the carrier bars with the guides laying the [fol. 884] yarn for the reinforcing portions are controlled between the end stops and the outer faces of the auxiliary stops. The inner margins of the reinforced portions can be made along lines extending diagonally to the direction of the wales and courses of the fabric, these lines extending diagonally inwardly and outwardly as desired, the adjustment of the auxiliary stops being accomplished automatically.

These various operations illustrate the availability and utility of the device when attached to a full-fashioned flat knitting machine in knitting stockings and include a large number of kinds of ornamental work, made desirable by the demands of the purchasing public.

Plaintiff claims that Schletter, by adding to the conventional control of the yarn guide carrier bars by the end stops, auxiliary stops for controlling certain of the said carrier bars, traveling less than the full course of the knit-

ting, said auxiliary stops being automatically adjustable to and from each other, their operation being automatically timed for proper synchronization with the end stops and other operating parts of the regular machine, gave to the full-fashioned hosiery machine a scope of operation not previously possessed, which permitted the making of ornamental inserts or split-seam work, ornamental reinforced designs, such as shadow clocks, and an ornamental reinforcement at the selvages on either legger or footer, in all the varied forms which these several kinds of work may take. This, it is claimed, he did by means of a comparatively simple attachment readily added to an old machine or made a part of a new one.

[fol. 885] The claims sued on are set forth in the margin, 1, 3, 14 and 15. "The straight knitting machine, with co-

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(1) In a straight knitting machine having cooperating yarn guide carrier bars, a pair of opposed stops for certain of said carrier bars which have a stroke less than the full width of the fabric being knitted, and a reversely threaded spindle for moving said stops toward and from each other to vary the stroke of the bars controlled by said stops. (3) A device as in claim 2, said pattern controlled means being constructed and arranged to turn said spindle either to increase or to decrease the distance between said stops. (14) In a straight knitting machine, a set of yarn guide carrier bars for operating yarn guides traveling less than the full width of the fabric being knitted, a spindle having reversed screw threads, stops operated by said spindle, means for turning the spindle in either direction, pattern-controlled means for determining the time of operation of the spindle, and pattern-controlled means for determining the direction of rotation of the spindle. (15) In a straight knitting machine, a set of reciprocating yarn guide carrier bars including bars having a stroke less than the width of the fabric being knitted, pair of stops for said guides, a reversely threaded spindle extending lengthwise of the machine, the respective stops being connected to the reversely threaded portion of the spindle for moving the stops simultaneously toward and from each other, pattern controlled means for determining the time for such movement, and correlated pattern controlled means for independently determining the direction of such movement.

operating yarn guide carrier bars," is the conventional Cotton machine for full-fashioned hosiery. The opposed "stops for certain of the carrier bars" are the auxiliary stops previously mentioned. By limiting the stroke of the carrier bar at each end of its travel, they make possible the split seam work mentioned. These auxiliary stops also act as opposed stops in making reinforced or shadow clock work. "The reversely threaded spindle for moving toward and from each other to vary the stroke of the bars controlled by said stops" implies automatic operation in both directions in accordance with the specifications of the patent. Claims 3 and 14 cover the same combination as claim 1. Claim 15 is somewhat more specific.

Defendant contends that plaintiff's commercial device [fol. 886] does not follow the patent because, first, solid non-oscillating stops have been substituted for the oscillating stops shown in the patent drawing, and, second, the timing and selecting mechanisms in the commercial form are operated by a single pattern chain instead of two as shown in the patent. While the patent shows one specific form of stop well known in the art, that is, a stop with an undercut portion, capable of oscillation, the patent, in its specifications, clearly indicated that the inventor did not intend to limit his alleged invention to these specific stops. He said: "My invention, however, is not limited to the use of these specific stops for this specific purpose, but they may be used for all purposes for which stops are used." Similar language appears elsewhere in his specifications. I am convinced that in any substitution in the device actually produced of solid stops for undercut stops, there is no material departure from the patent, but rather an adherence to its teaching. In other words, under the evidence, stops and their functions were well known. The patentee did not invent a new form of stop, but his idea, as I understand it, was to control the movement of stops laterally in the machine. This he did by his reversely-threaded spindle and automatic reversing means in conjunction with the regular control of the full-travel bars by the end stops. In making the open or herring-bone split the undercut stops were oscillated. In making the closed split, the oscillating means were rendered inoperative, without oscillation, just as if they had been solid stops. The evidence is that the undercut stop was provided, not only with the oscillating means but also with [fol. 887] means for putting the oscillating mechanism out

of operation, so that the stops could be used either as solid stops or as oscillating stops. The practice of utilizing the stops in their two capacities is apparently well known in the art, and makes possible the closed split seam as well as splicing work. I think a fair interpretation is that the specifications of the patent not only disclose the alternative use of solid stops without the undercut but further that the specific form of stop with its oscillating means, involved a disclosure to those skilled in the art of a well known form of stop, to be oscillated in making the open split and to be disconnected and not oscillated in making a closed split or for reinforcing or splicing work. Apparently Schletter preferred to make an open split, in vogue in his time, but the device which he disclosed was capable of use in the manner known to the art in making closed splits, and the fact that when the plaintiff commercialized its device it omitted the means for oscillating the stops, the open split being no longer in vogue, involved no departure from the patent.

Plaintiff has substituted a single pattern chain for controlling both the timing and selecting mechanisms in place of the two separate chains shown in the patent, but the one chain, by virtue of the mechanism provided, performs the function of both the former chains. The device exemplifies elimination of two chains, replacement with one performing the same function. The claims of the patent are not so framed in describing the timing and selecting mechanisms as not to include such simpli-cations. Equivalency is clear [fol. 888] Commercial success followed the production of the attachment, which now forms an essential feature of substantially all flat knitting machines. Testimony of various manufacturers fully establishes this fact. The German machines, if not equipped with such attachment, are supplied therewith by the purchaser.

Defendant contends that Schletter was anticipated, and counsel relies upon thirteen patents cited in Textile Machine Works v. Hofmann, supra, and now cites twelve additional patents.

The claims of the patent in suit cover in the full-fashioned flat knitting machine, with its provided reciprocatory carrier bars, a combination of full travel thread bars, controlled by the end stops short travel bars, which cooperate with the full travel bars, in making designs on the hosiery, auxiliary stops for controlling the short travel bars, the reversely-threaded spindle, for moving the stops toward and from

each other, automatic means for moving the auxiliary stops in either direction, means for timing the operation of the spindle and means for selecting the direction of rotation of the spindle.

Of the twelve patents cited here for the first time, the following: Laue and Timaeus (German) No. 21,332 of 1881; Black (British) No. 13,905 of 1887; Rowlet (U. S.) No. 500,953 of 1893; Chipman (U. S.) No. 1,163,970 of 1915; Mather (British) No. 7,476 of 1837; Roe (British) No. 1,991 of 1869; Willat, et al. (British) No. 573 of 1871; Claringburn (British) No. 7,068 of 1891; Kilbourne (U. S.) No. 19,370 of 1856; Lieberknecht (German) No. 117,153 of 1900; De Pass (British) No. 10,405 of 1884; Oesterreich (U. S.) [fol. 889] No. 1,644,688 of 1927, relate to machines which have no auxiliary carriers but employ merely full travel carriers. I cannot find in any of them any pertinent relation to the subject matter of the patent in suit. Practically all of them relate not to an attachment for the Cotton machine, but to one of entirely different type, the independent needle machine, without reciprocating carrier bars. For these as well as other reasons appearing in evidence, these patents clearly do not anticipate.

Lieberknecht (German) No. 117,153 has to do only with the control of full travel carrier bars. Under his construction no designs can be made by the machine. The device supplies in a knitting machine of the Cotton type for the ordinary end stops of the latter, that patentee's equivalent. De Pass (British) No. 10,405 is intended to make designs upon hosiery, but by means entirely alien to that employed in the instant patented device. It does not involve the control of reciprocating carrier bars, but employs the carrier control of the independent needle machines. This patentee proposed a specific form of design, and his device is entirely limited to that, having no capability for the various kinds of designed work of which the attachment in suit is capable. There are in most of the prior art patents thus far considered no reversely-threaded spindle or otherwise.

Oesterreich, No. 1,644,688, discloses a drum attachment for doing design work on the Cotton machine. There is here again no reversely-threaded spindle, and consequently no automatic mechanism for controlling such spindle. The patent covers an attachment for producing designs, but such

[fol. 890] productions follow a process entirely different from that of Schletter.

The Chamberlain publication, which is likewise new in this case, refers to a reversely-threaded spindle and to use of same for reducing or increasing the traverse of yarn guides. Plaintiff does not contend that the patent in suit covers such device. The article contains no teaching of the use of a reversely-threaded spindle in the manner of Schletter or to accomplish his purpose.

There remain thirteen patents cited, which were before the court in the Hofmann case. That suit was defended by the same counsel for a different client, and the president of the present defendant attended the trial of that case,—testified therein and assisted in the defense. The defendant contributed to the defense of the former suit, and the defendant in the former suit is contributing to the defense of this suit. These facts bring the present case very nearly within the doctrine of res adjudicata and though it may be that not all of the elements of that doctrine necessary to an estoppel by judgment exist, so far as the prior art relied upon in the former case is concerned, this trial is in the nature of a rehearing of the evidence heard in the prior suit in the district court, the decree of which was affirmed by the Circuit Court of Appeals for the Third Circuit. This court is loath to rehear issues previously decided by a court of coordinate jurisdiction, whose decree has been affirmed by the court of review. However, in the absence of applicability of the doctrine of res adjudicata, present defendant has a right to a full hearing of its defense.

[fol. 891] Claringburn (British), No. 4967, has to do with a Cotton machine so modified as to narrow the fabric at the selvage or at some distance in from the selvage, the purpose being to provide ladies' garments with gores or pockets. Claringburn contains no reversely-threaded spindle; has nothing to do with carrier rod control and pertains only to narrowing, which is old. The spindles may operate in opposite direction, but not in order to position auxiliary stops or otherwise except to produce narrowing.

Sowter, No. 478,527, comes within the same classification. He was dealing with narrowing.

Lieberknecht, No. 981,663, shows a reversely-threaded spindle for controlling the travel of yarn guide carriers, the purpose of which is to reduce the shocks of blows incident to the striking of the carrier bars on the stops. The

device relates solely to the control of full travel carrier bars and lacks entirely auxiliary stops for controlling the short travel bars. The spindle is automatically operated in one direction only and in the other by hand. The device will not accomplish Schletter's purpose.

Woodward, No. 19,627, contains only the regular stops for full travel bars. There are no auxiliary stops; no short travel bars, and the reversely-threaded spindle is not that of Schletter. Defendant offered testimony that certain changes might be made in the device whereby it might be adapted to produce one of the types of work covered by Schletter's patent. I do not believe the modified device follows the teaching of Woodward. But more than that, it is not sufficient to constitute an anticipation that the device might by modification be made to accomplish the function [fol. 892] performed by the patent in suit, if it were not designed so to do by its maker or adapted when actually used, for the performance of such functions. Topliff v. Topliff, 145 U. S. 156.

Gee, in his Patent No. 1,014,753, devised an attachment for making reinforced or spliced designs away from the selvage. He controlled his short travel bars by fixed stops, which have no movement in a longitudinal direction, as in Schletter. The attachment is capable of doing only one kind of work, and only one design can be achieved by the use of any one form of pattern abutment. There is no reversely-threaded spindle. The device cannot be employed for split seam or insert work, and has certain other defects not necessary to be considered.

Landenberger, No. 1,134,749, is a drum device similar to that of Oesterreich. The drums are operated in one direction only, and the device fails to meet Schletter's claims, as there are no auxiliary stops movable automatically toward or from each other and no reversely-threaded spindle so to move the stops. This attachment has been practically superseded by the attachment of Schletter. Drum devices are used to some extent at the present time, but they follow teachings different from those of Schletter.

Schletter, No. 1,198,482 is very similar to that of the Landenberger's device just considered. It was intended to make the pointex heel reinforcement and utilized for that purpose, a drum device. It fails to anticipate, for the same reason that Landenberger fails.

Cecka, No. 1,180,568 covers a device for making reinforced portions in the medial parts of the fabric, that is shadow [fol. 893] clock work. He has no other purpose in mind, and the device fails to comprehend the concept of Schletter.

Cecka, No. 1,217,411 has to do with reinforcement of the selvage. It is similar to Cecka Patent No. 1,180,568 and fails to meet Schletter. The Examiner allowed Schletter's claims over this reference. These two patents are of especial interest in this case because of the fact that they represent attempts made by the defendant's associates to solve at least a part of the problems Schletter coped with. The devices were crude and of no practical merit, but are of some weight upon the question of invention by Schletter.

Zwicky, No. 1,608,285, employs a reversely-threaded spindle but one entirely different from that of the patent in suit.

Cotton, British No. 208,362, utilizes the reversely-threaded spindle as a one-way device for controlling auxiliary stops to make the pointex heel. It is similar to Gotham and Kayser, in evidence under prior uses. The spindle operates in one direction only and lacks the automatic reverse and other mechanism included in Schletter. Furthermore it appears that Schletter's date of invention was prior to that of Cotton.

Lamb and Noon, British No. 15,129, covers a machine for making split seam designs of a particular pattern. There is no carrier bar which carries a guide for laying thread across the full length of the fabric. There is no reversely-threaded spindle for controlling auxiliary stops. It is suggested that with certain changes Lamb might accomplish something other than what he claimed. But the suggested [fol. 894] changes involve supplying new elements and building a new combination.

Muller, in No. 1,564,438, was dealing with an independent needle machine. He employed no reciprocating carrier bars, no combination of short travel bars and full travel bars with fitting automatic control. Muller was not dealing with full-fashioned machines. The function of his spindle was not to control auxiliary stops, as in plaintiff's combination, but to perform another function. Muller could not accomplish the various types of work contemplated by Schletter. Furthermore the reference is not sufficiently early to anticipate Schletter's invention.

Gotham and Kayser employ attachments for making pointex heels; involving a single kind of selvage edge reinforcement which was used for some years to make pointex heels. Apparently these devices were equivalent to that illustrated in the Cotton British patent. They are no longer in use, for the reason that the Schletter attachment has superseded them because it will make, not only pointex heels, but various numerous types of ornamental work. These prior uses involve one way devices. The threaded spindle is operated by mechanism in one direction only and is racked out by hand. They contemplated no automatic operation in both directions, no selective or reversing mechanism, and the auxiliary stops are not utilized as opposed stops.

The Nussbaum machine was used in the manufacture of underwear and bathing suits. It was not adapted to make full-fashioned hosiery, but utilized regular fashioning screws or spindles at the opposite ends of the machine and the regular end stops to control the travel of short travel [fol. 895] bars, laying in the thread for designs, thus ornamental designs. In this device there were auxiliary stops at each end of the machine to do the work which would be done ordinarily by the regular end stops. It was impossible with this machine to achieve the purpose of Schletter. It could make garments with straight selvages only. The device lacks the essence of the Schletter invention, namely, an attachment to be added to the regular full-fashioned machine, providing auxiliary stops, automatically controlled, additional to and co-operating with the regular end stops on the machine, so that while the machine is knitting full-fashioned hosiery, short travel bars are automatically controlled to lay in the yarn necessary to make the desired ornamental designs.

Some of these patents have to do with control of narrowing points; others with control of full travel bars; others are single purposed devices. Others show specially designed machines but do not relate to an attachment for full-fashioned hosiery and others relate to independent needle machines, not involving the control of carrier bars. A new combination cannot be anticipated by piecing together the various elements from disconnected patents. Thus in Davis Mfg. Co. v. Levin Bros., 8 Fed. (2d) 972 at 976, the Court of Appeals said:

"It is familiar doctrine in the law of patents that, after an invention, an infringer may not piece together from a

number of disconnected patents in the same or other arts a combination of features which would render the patented combination invalid; particularly when there is added a [fol. 896] new and distinctive efficiency as the result of the combination made by the patentee as distinguished from combining a number of old elements, all functioning as before without that new and distinctive result."

See also J. L. Owens Co. v. Twin City Separator Co., 168 Fed. 259; at 265 (C. C. A. 8th); Black & Decker Mfg. Co. v. Baltimore Truck Tire Ser. Corp., 40 Fed. (2d) 910 at 912, 913 (C. C. A. 4th); Wisconsin-Minnesota Gas & Elec. Household Co. v. Hirschy Co., 28 Fed. (2d) 838, at 841 (C. C. A. 8th); Bragg-Kliesrath Corp. v. Farrell, 36 Fed. (2d) 845, at p. 849 (C. C. A. 2nd); Bassick v. Larkin Co., 19 Fed. (2d) 939, 940.

I am of the opinion that none of the prior art or uses cited anticipate Schletter.

It is contended that no invention was achieved, but after careful consideration of the evidence, I am of the opinion that Schletter accomplished invention. Instead of the old combination intended for one purpose, he brought about a new attachment adapted not only for selvage reinforcement of any desired form, but as well for split seam work, fancy insert work, away from the selvage, and spliced designs such as shadow clock work. He thus provided for the full-fashioned hosiery machine, for the first time in the history of the art, a single, efficient new attachment for accomplishing a wide variety of work never before accomplished by any single device. In dealing with a new combination, the question of patentable invention turns not merely upon the [fol. 897] question of the extent and nature of the mechanical changes, but rather upon the question of novelty of function and result. The addition of mechanism for accomplishing the purpose of the new combination must be preceded by the conception of the purpose and the recognition of the availability of the old device, with the addition of the new necessary mechanism, for the accomplishment of the new purpose and added functions. By adding the automatic reverse, with the necessary operating, selecting and timing mechanisms, Schletter produced a new combination, giving to the auxiliary stops functions which they did not possess in the old pointed heel device and producing an entirely new result. He turned a device intended for a single pur-

pose into one of general utility, opening up a whole field of new uses, which those familiar with the old attachments had not conceived. Such steps as this show invention. Diamond Rubber Co. v. Consolidated Co., 220 U. S. 428; Temco v. Apco, 275 U. S. 319; Bragg-Kliesrath Corp. v. Farrell, 36 F. (2d) 845; Thropp & Sons Co. v. De Laske, 226 Fed. 941, 947.

Defendant has insisted that Schletter's device is inoperative. Its point is that while the spindle, the means for operating the same and the timing and selecting mechanism are all clearly shown and described, including a pattern chain, which operates the selective mechanism, and a pawl which moves the pattern chain, there is obscurity with respect to the lever connection by which the pawl is actuated from the main cam shaft. To support this contention, is the testimony of an expert witness to the effect that he cannot determine from the patent drawing the pawling mechanism for the chain. But this witness finally said, on [fol. 898] cross examination, that the specifications disclose that the lever for actuating the pawl was intended to be operated by the cam shown in the drawing. His final position was that the only thing missing from the patent drawing was the arm connecting the lever at the front of the machine to the pawl at the rear. The connection is not bodily shown in the drawing, but it seems obvious to the Court that anyone familiar with drawings, reading the specifications, would know and appreciate the exact form of the connection desired and intended. I am of the opinion that patentee has described his invention in such a manner as to meet the requirements of Revised Statute, Sec. 4888.

Patents are never struck down by reason of trivial defects which do not prevent those skilled in the art from putting the device into practice. That the alleged defect relied upon by defendant here is of such trivial character seems too clear to require further comment. Webster Loom Co. v. Higgins, 105 U. S. 580; Sun Ray Corp. v. Bellous, 49 F. (2d) 886, 887; Bickell v. Smith Hamburg-Scott Co., 53 F. (2d) 356.

What has been said in this connection applies with equal force with regard to failure to show in the drawings narrowing cams which are an essential part of a knitting machine.

From a careful consideration of the evidence, therefore, I am of the opinion that Schletter achieved invention; that

he is not anticipated; that he has met the requirements of the statute in his description of his invention and that his patent discloses no inoperative defects.

In the alleged infringing device, a single chain for controlling the timing and selecting mechanism has been sub- [fol. 899] stituted for the two pattern changes of the patent. This is another way of saying that the defendant here, as did the defendant in the Hofmann suit, has followed plaintiff's commercial form of device, which the Court has previously said is not a departure from the teaching of the patent. The substitution of one chain with additional buttons, for two chains, accomplishing the same purpose as two chains, does not prevent infringement, just as it is no departure from the teaching of the patent.

Defendant contends also that in its device it has provided stops which are of special improved character, adapted to make a two needle split seam, whereas in Schletter the split seam must be a four needle split, which is alleged to be less desirable than the other. I do not understand that the patent, in the claims herein involved, is limited to any particular form of split seams. Rather the claims are directed, not to any specific form of stop but to a combination of stops of well known character, either for split seams or splicing and controlling and operated in a particular manner in connection with the parts of a full-fashioned knitting machine to bring about a wide variety of designs on hosiery. I do not conceive that infringement can be escaped by the use of a form of stops which permit the making of a particular seam which the defendant claims is more desirable than the specific form shown in the patent, where various forms including the one being considered, are claimed. It appears that defendant's attachment may be utilized to make the four needle split and for splicing exactly in the same manner and form as the plaintiff's commercial attachment. In the end what defendant does [fol. 900] is to employ an attachment embodying plaintiff's combination with an added device for raising and lowering pin stops in order to adapt the device to a particular form of split seam. Such addition, utilized only with plaintiff's combination, cannot relieve defendant of the charge of infringement. Walker on Patents (6th Ed.), p. 496; Sec. 409; Temco Electric Co. v. Apco Mfg. Co., 275 U. S. 319; Mabina v. Grisman, 20 F. (2d) 406; Barber v. Otis Motor, 231 Fed.

755, 762; Stabler v. Riverside Heights Assoc., 205 Fed. 735, 739.

Furthermore, inasmuch as the added connection is adapted to be put out of operation and the pin stops used as ordinary split seam and splicing stops, the device accomplishes exactly the result of Schletter. A machine that infringes part of the time is an infringement, although it may at other times be so operated as not to infringe. Wright Co. v. Herring-Curtis Co., 211 Fed. 654, 655 (C. C. A. 2nd); Westinghouse Co. v. Precise Corp., 11 Fed. (2d) 209. I find, therefore, nothing in the defendant's device that excuses it from the charge of utilization of the combination of the Schletter patent.

I might with propriety have rested my decision largely upon the prior adjudication in the Third Circuit, for a strong presumption arises from such previous decision. Thus, the Court of Appeals for this Circuit, in Gormley & Jeffery Tire Co. v. U. S. Agency, 177 Fed. 692 (C. C. A. 2d) said:

"The importance of securing uniformity in the law as administered in the several circuits in patent causes is so [fol. 901] great that a decision of a court of co-ordinate jurisdiction should be followed by this court in every case where the questions presented can fairly be regarded as doubtful."

See also Warren Bros. Co. v. City of N. Y., 187 Fed. 831, 835 (C. C. A. 2d); Adt. v. Kirstein Sons Co., 259 Fed. 277, 278; McLaren Products Co. v. Cone Co., 7 Fed. (2d) 120, 128; Rousso v. Elco Cabinet Co., 28 Fed. (2d) 300. But I have not felt satisfied to rely solely upon the strong presumption arising from the earlier adjudication. I have considered not only the evidence identical with that submitted in the prior litigation but in addition new evidence. Only by so doing have I felt that the Court's obligation to the defendant can be fully performed.

There will be a decree of validity of the claims sued upon, infringement by defendant and a reference to the master for an accounting for damages. Proper form may be submitted.

Entered this — day of February, A. D. 1936.

Walter C. Lindley, Judge.

[fol. 902] IN UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF NEW YORK

[Title omitted]

Findings of Fact and Conclusions of Law

FINDINGS OF FACT

1. Plaintiff is a Pennsylvania corporation, and defendant is a New York corporation.

2. Plaintiff owns by mesne assignment, Letters Patent of the United States No. 1,713,628, issued May 21, 1929, to Schletter & Zander, Inc., for an attachment for flat knitting machines, and of all rights of recovery for infringement thereof.

3. The said patent was before the District Court in New Jersey and the Court of Appeals of the Third Circuit in the case of Textile Machine Works vs. Alfred Hofmann, Inc., in Equity No. 4219, and was held valid and infringed as to claims 1, 3, 14 and 15 thereof.

4. The device shown and described in the patent in suit is an attachment for full fashioned knitting machines for knitting hosiery, whereby the knitting machine is adapted [fol. 903] for knitting stockings provided with reinforced designs or so-called split-seam designs in any desired portion of the stocking at or between the selvages.

5. The attachment of the said Letters Patent has been manufactured and sold in large quantities by the plaintiff; the device has been commercially successful; has gone into general use on full fashioned knitting machines throughout the United States, and has been received and recognized in the knitting industry as a valuable addition to the full fashioned knitting machine.

6. Schletter, upon whose application the said Letters Patent were granted, was the original, first and sole inventor of the said attachment.

7. The invention of the attachment was made and completed by the said Schletter prior to June 19, 1922, the said invention having been reduced to practice prior to said date by embodiment in a full sized operative machine.

8. Said Schletter filed his original application for a patent for the said device on June 19, 1922, which application, apparently, without the intention of the inventor, subsequently became abandoned.

9. Following the making and completion of the invention, as aforesaid, there was no relinquishment or abandonment thereof by the said inventor, or surrender of the same to the public.

10. The patent discloses an operative and useful device. All parts essential to proper operation are disclosed in the [fol. 904] specification, or necessarily implied from the description.

11. The disclosure of the patent is sufficient to enable any person skilled in the art to which the machine appertains to make, construct and use the same.

12. The combinations set forth in claims 1, 3, 14 and 15 of the said Letters Patent were novel. None of the prior art patents, or publications, or prior uses relied upon by defendant constitutes an anticipation.

13. The evidence of the prior art as contained in the record fails to show that the attachment covered by claims 1, 3, 14 and 15 of the patent was obvious to those skilled in the art, or that it involved ordinary mechanical skill, falling short of invention.

14. Since the grant of the patent and prior to the filing of the bill of complaint herein, defendant has, without consent of the plaintiff, sold within the United States full fashioned hosiery knitting machines, leggers and footers, provided with attachments, the attachments for such machines being identified in the record by photographs marked herein "Plaintiff's Exhibit 2."

15. Defendant's said attachments, identified in the photographs Plaintiff's Exhibit 2, embody and employ the several elements recited in claims 1, 3, 14 and 15 of the said Letters Patent No. 1,713,628, and each of them, said elements being combined in substantially the same way, with the same [fol. 905] mode of operation, and accomplishing the same results as in the patent in suit.

16. On or about the 30th day of June, 1930, plaintiff notified the defendant of plaintiff's said patent and of de-

fendant's infringement thereof by the sale of the aforesaid attachments, and after the receipt of such notice, defendant continued, within the United States, to sell the said attachments without the consent of plaintiff.

CONCLUSIONS OF LAW

1. The Letters Patent of the United States No. 1,713,628 issued May 21, 1929, for attachment for flat knitting machines, are good and valid in law as to Claims 1, 3, 14 and 15 thereof.

2. The attachments sold by the defendant, Louis Hirsch Textile Machines, Inc., and identified in the record by the photographs "Plaintiff's Exhibit 2," embody the invention or inventions set forth in Claims 1, 3, 14 and 15 of said Letters Patent, and each of them, and defendant has infringed the patent as to said claims, and each of them, by the unauthorized sale, within the United States, of the said attachments.

3. Plaintiff is entitled to a writ of permanent injunction, enjoining defendant from the further sale of the aforesaid attachments and any further infringement of the plaintiff's patent in suit.

4. Plaintiff is entitled to recover from defendant, the profits and gains received by defendant and the damage [fol. 906] suffered by plaintiff by reason of the aforesaid infringement of the patent in suit and to recover its costs and disbursements of this proceeding, in accordance with the statutes and rules in such cases made and provided.

5. The findings and conclusions of the memorandum of the Court, adopted simultaneously herewith, are made a part hereof as fully as if expressly included herein.

6. Plaintiff is entitled to a decree as prayed.

Adopted and entered this — day of February, A. D. 1936.

Walter C. Lindley, Judge.

IN UNITED STATES DISTRICT COURT

[Title omitted]

PETITION FOR REHEARING

Now comes the defendant, Louis Hirch Textile Machines, Inc., and by its solicitors respectfully petitions this Hon-

[fol. 907] orable Court to grant a rehearing of this cause upon the following points and for the reasons hereinafter briefly stated:

1. The Court failed to consider or to render any decision in this cause with respect to the defense presented by the petitioner at the trial that claim 10 of the Schletter patent in suit is invalid on its face.

2. Although plaintiff herein sued only upon claims 1, 3, 14 and 15 of the patent in suit, the petitioner clearly had the right under its pleadings to challenge the validity of claim 10 of the patent in suit and to have the Court consider such a defense and to render a decision in the case with respect thereto.

With respect to the right of petitioner to challenge the validity of claim 10 of the patent, attention is called to the following authorities:

Seymour v. McCormick, 60 U. S. (19 How. 66);
Sessions v. Romadka, 145 U. S. 29: 36 L. Ed. 609;
Singer v. Walmsley, Fed. Case 12,900;
American Bell Telephone Co. v. Spencer, 8 Fed. 509;
Stutz v. Armstrong, 20 Fed. 843;
Hall v. Biddle, 27 Fed. 560;
Suddard v. American Motor Co., 163 Fed. 852

3. Claim 10 of the patent in suit is obviously invalid because it is misdescriptive, unsupported by the disclosure of the patent, and contrary to said disclosure, and such [fol. 908] invalidity is clearly apparent by a mere inspection and examination of the specifications and drawings of the patent.

4. Testimony given at the trial also conclusively shows that claim 10 of the patent in suit is invalid on its face. In this connection the attention of the Court is called to the testimony of plaintiff's expert witness, Meyer, during his cross examination (Record pp. 142 and 143) where he unequivocally admitted that the specifications and drawings of the patent did not disclose or describe any "pattern controlled means to tilt the stops" of the attachment of the patent, as is called for in said claim.

5. The plaintiff has admitted the invalidity of claim 10 of the patent, since the trial, by filing a disclaimer of said

claim in the United States Patent Office on January 18, 1936.

6. The failure of the Court to rule that claim 10 of the patent in suit is invalid seriously affects petitioner's rights in this suit for the following reasons:

(1) A ruling by the Court that claim 10 of the patent is invalid would preclude the plaintiff from recovering any costs in the suit in view of the provisions of Section 973 of the Revised Statutes.

(2) A ruling by the Court that claim 10 of the patent is invalid would also entitle the petitioner to a further ruling by the Court, in view of the provisions of R. S. 4917 and 4922, that the entire patent is invalid and that the [fol. 909] plaintiff was not entitled to maintain this suit because of its unreasonable neglect and delay in filing a disclaimer of said invalid claim.

(3) A ruling by the Court that claim 10 of the patent is invalid would entitle the petitioner to a dismissal of this suit in view of the provisions of R. S. 4917 and 4922 and the interpretation given said statutes by the United States Supreme Court in the case of Ensten v. Simon Ascher Co., 282 U. S. 455; 75 L. Ed. 453.

7. The failure of the Court to rule that claim 10 of the patent is invalid on its face and to hold that the entire patent in suit is invalid because the plaintiff has not complied with the requirements of the disclaimer statutes R. S. 4917 and 4922 also seriously affects the rights of the public at large.

It is therefore believed that in view of the facts and authorities above set forth the petitioner is entitled to a ruling by the Court upon its defense presented at the trial as to the validity of claim 10 of the patent in suit and that a rehearing on this point should be granted.

Darby & Darby, Solicitors for Defendant.

I hereby certify that I am counselor and solicitor for Louis Hirsch Textile Mechines, Inc.; that the foregoing petition is in my opinion well founded both in point of law and on question of fact and is deserving of judicial consideration; and that the same is not interposed for delay.

Walter A. Darby.

[fol. 910] IN UNITED STATES DISTRICT COURT

[Title omitted]

ANSWER TO PETITION FOR REHEARING

The Petition for Rehearing filed by Defendant seeks review of the contention made in Defendant's Brief that Claim 10 of the Schletter patent is invalid, and that a disclaimer should have been filed by the Plaintiff with respect to this claim at the conclusion of the trial, or shortly thereafter.

1. This question was raised and argued in Defendant's Brief, pages 87 to 89 under Point IV, entitled "The Patent is Invalid Because of Undisclaimed Invalid Subject-Matter" where Claims 7 and 8 were attacked, as well as Claim 10. Plaintiff answered this portion of Defendant's Brief in its Reply Brief, pages 26-27. For the convenience of the Court, these portions of Defendant's Brief and Plaintiff's Reply Brief are attached hereto and marked Exhibits 1 (a) and 1 (b), respectively.

Defendant, by its Petition for Rehearing, seeks review of a point by the Court which was fully presented to it in [fol. 911] the Briefs and before the Opinion was handed down, which Point the Court in awarding relief to the Plaintiff, necessarily considered to be without merit.

2. The question of the invalidity of the patent, because of unreasonable delay in filing a disclaimer, involves a special defense which must be pleaded. Zell vs. Bankers' Utilities Co., 77 Fed. (2d) 22; Burden vs. *Corning*, 4 Fed. Cases, 701 at 710, No. 2143; Worden vs. Searls, 21 Fed. 406. This is in fact what Defendant seeks, not merely a finding with respect to the validity of a claim which was not in issue. (See Section 6 of Petition.)

In the present case Plaintiff, as is stated in Defendant's Petition for Rehearing, paragraph 2, sued only on Claims 1, 3, 14 and 15 of the Schletter patent. Under these circumstances, the invalidity of claims not in suit and the necessity for a disclaimer thereof, if the questions can be properly considered by the Court, must clearly be specifically pleaded. The Court of Appeals for the Second Circuit, in Trussell Mfg. Co. vs. Wilson-Jones Co., 50 Fed. (2d) 1027 at 1030 refused to consider the validity of claims

not in suit "for neither the Answer, nor any Assignment of Error, raised it."

The Defendant realizing the fact that the defense must be specifically pleaded asserts in the Petition, paragraph 2 that under its pleadings it had the right to challenge the validity of Claim 10. An examination of the Answer and amendments thereto filed by the Defendant shows that no defense relating to the necessity of disclaimer in view of the alleged invalidity of Claim 10 was pleaded. For the convenience of the Court, copies of the Answer and amend-
[fol. 912] ments thereto are attached hereto and marked Exhibit 2.

Not only was there no notice of the defense in the Answer, or amendments thereto, but no reference was made thereto at any stage of the trial, and Plaintiff obviously had no opportunity to submit, or reason for submitting, evidence on any such issue.

It is not the practice of the Courts to pass on the validity of claims not in issue for any purpose, e. g., for the purpose of determining the necessity of a disclaimer with respect thereto. Gamewell Fire-Alarm Telegraph Co. vs. Municipal Signal Co., 77 Fed., 490; Sirocco Engineering Co. vs. B. F. Sturtevant Co., 209 Fed., 624; American Bell Telephone Co. vs. Spencer, 8 Fed., 509.

In Aluminum Colors, Inc. vs. United States Research Corporation, 7 Fed. Supp., 609, the Court refused to consider the necessity of a disclaimer with respect to a claim not in issue on Motion of Defendant after decision in the case had been rendered.

3. Point 3 of Defendant's Petition is denied by the Plaintiff. This matter has already been discussed in Plaintiff's Reply Brief (see Exhibit 1 [b]).

Under the conditions here, the necessity for disclaiming could not arise until there had been an adjudication that the claim is in fact invalid. The Plaintiff has the right to reply upon the presumption of validity as to the claim which resides in the grant of the patent. Ensten vs. Simon Ascher Co., 282 U. S., 445; Aluminum Colors vs. United States Research Corporation, 7 Fed. Supp., 609.

[fol. 913] 4. Point 4 of Defendant's Petition is also denied by Plaintiff. The inaccurateness of Defendant's assertion is to be seen from an examination of the Record, pages

142 and 143, referred to by Defendant. These pages are attached hereto and marked Exhibit 3 for the convenience of the Court. The witness, Meyer, did not admit that the tilting of the stops referred to in Claim 10 is not effected by pattern controlled means, as the claim requires, but merely stated that it is not effected by pattern chain control means. Further, it is obvious that the witness had in mind merely the auxiliary chains for controlling the auxiliary stops, and was not referring at all to the regular pattern chain of the machine which controls the shifting of the main cam shaft, which shifting in turn does effect the tilting of the auxiliary stops, as was pointed out in Plaintiff's Reply Brief. (Exhibit 1 [b].)

5. Point 5 of Defendant's Petition is denied as a matter of law. Permutit vs. Wadham, 13 Fed. (2d) 454; United Chromium, Inc. vs. International Silver Co., 60 Fed. (2d) 913; Lowell vs. Triplett, 77 Fed. (2d) 556; Bay State Optical Co. vs. Klein, 20 Fed. (2d) 915.

6. The Defendant is not accurate in its statements in Paragraph 6 of the Petition, since even a holding of invalidity of Claim 10 would not entitle Defendant to a dismissal of the suit. Defendant would have to establish unreasonable neglect and delay in the filing of a disclaimer, a special defense obviously not raised by the pleadings.

* * * * * * *

[fol. 914] It will be apparent that Defendant, by its Petition for Rehearing, merely seeks a re-argument of a point which was fully presented by the Briefs heretofore filed; and in accordance with the settled practice in such cases, it is submitted that the Petition should be denied.

Respectfully submitted, Howson and Howson, Attorneys for Plaintiff.

IN UNITED STATES DISTRICT COURT

[Title omitted]

ORDER DENYING PETITION FOR REHEARING

Defendant has presented to the court its petition for rehearing and the plaintiff has filed its answer in opposition

thereto. Upon reconsideration of the record and of the authorities cited, I conclude and it is ordered that the petition for rehearing be, and the same is hereby denied.

Entered this 21st day of March, A. D. 1936.

Walter C. Lindley, Judge.

[fol. 915] IN UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF NEW YORK

In Equity. No. 63-32

TEXTILE MACHINE WORKS, Plaintiff,

vs.

LOUIS HIRSCH TEXTILE MACHINES, INC., Defendant

INTERLOCUTORY DECREE

This case came on to be heard and was argued by counsel, and thereupon, upon consideration thereof, it is

Ordered, Adjudged and Decreed

1. That Letters Patent of the United States No. 1,713,628, granted to Schletter and Zander, Inc., assignee of Richard E. Schletter, May 21, 1929, for Attachment for Flat Knitting Machines, are, as to claims 1, 3, 14, and 15 thereof, good and valid in law.

2. That the plaintiff, Textile Machine Works, is the sole and exclusive owner of the entire right, title, and interest in and to said Letters Patent No. 1,713,628, including all rights of recovery for infringement thereof.

3. That the defendant, Louis Hirsch Textile Machines, Inc., has infringed said Letters Patent No. 1,713,628 with respect to said claims 1, 3, 14, and 15 thereof, and has [fol. 916] violated the exclusive rights of the plaintiff therein by making and selling within the United States machines or attachments embodying and containing the invention of said Letters Patent as set forth in said claims 1, 3, 14, and 15; the said machines or attachments made and sold by defendant being more particularly referred to and described in the photographs, Plaintiff's Exhibit 2, and the stipulation of record referring to said photographs.

4. That a writ of injunction issue out of and under the seal of this Court, directed to the defendant, Louis Hirsch Textile Machines, Inc., perpetually enjoining and restraining the said defendant, its clerks, attorneys, agents, servants and workmen, and all claiming through or under them, and each of them, from directly or indirectly making, or causing to be made, using, or causing to be used, or selling, or causing to be sold, any machine or attachment embodying or containing the invention of claims, 1, 3, 14, and 15 of said Letters Patent, or either or any of said claims, and particularly the machine or attachments heretofore made and sold by said defendant as identified in the aforesaid Plaintiff's Exhibit 2 and stipulation.

5. That the plaintiff recover from the defendant, Louis Hirsch Textile Machines, Inc., the profits, gains, and advantages which the said defendant has received or which may have accrued to it by reason of defendant's said infringement, and the damages which the plaintiff has suffered by reason of said infringement, and that this cause be referred to , as Special Master, to ascertain, take, [fol. 917] state, and report to the Court an account of said gains, profits and advantages, and the said damages.

6. That the plaintiff do recover of the defendant its costs and disbursements of this suit to be taxed, and that the question of increase of damages, and all further questions, be reserved until the coming in of the Master's report.

Walter C. Lindley, U. S. District Judge.

——, 1936.

IN UNITED STATES DISTRICT COURT

[Title omitted]

PETITION FOR APPEAL

The above named defendant, Louis Hirsch Textile Machines, Inc., conceiving itself aggrieved, by the interlocutory decree entered herein on April 13th, 1936, does hereby [fol. 918] appeal from said decree to the United States Circuit Court of Appeals for the Second Circuit for the reasons specified in the assignment of errors which is filed herewith, and it prays that this appeal may be allowed and

citation granted directed to the above named plaintiff Textile Machine Works, demanding it to appear before the United States Circuit Court of Appeals for the Second Circuit to do and receive what may appertain to justice to be done in the premises; and asks that a transcript of the pleadings, proceedings, testimony, exhibits and orders, together with a copy of the opinion of this Court filed in this cause upon which said decree was entered, duly authenticated by the Clerk of the Court, be transmitted to the United States Circuit Court of Appeals for the Second Circuit under the rules and statutes in such cases made and provided.

Louis Hirsch Textile Machines, Inc., by Darby & Darby, Solicitors for Defendant.

Dated April 18, 1936.

IN UNITED STATES DISTRICT COURT

ORDER ALLOWING APPEAL

It is Ordered this 18th day of April, 1936, that the foregoing appeal be allowed.

Robert P. Patterson, United States District Judge.

[fol. 919] IN UNITED STATES DISTRICT COURT

[Title omitted]

ASSIGNMENT OF ERRORS

The defendant, Louis Hirsch Textile Machines, Inc., in the above entitled suit conceiving itself aggrieved by the decree entered therein on the thirteenth day of April, 1936, now appearing by its counsel and presents with the accompanying petition for appeal from said decree the following assignment of errors:

1. The Trial Court erred in entering a decree adjudging claims 1, 3, 14 and 15 of Schletter patent No. 1,713,628 to be valid.

2. The Trial Court erred in failing to enter a decree adjudging claims 1, 3, 14 and 15 of Schletter patent No. 1,713,628 to be invalid because of anticipation.

3. The Trial Court erred in failing to enter a decree adjudging claims 1, 3, 14 and 15 of Schletter patent No. 1,713,628 to be invalid for want of patentable novelty.

[fol. 920] 4. The Trial Court erred in failing to enter a decree adjudging the Schletter patent No. 1,713,628 to be invalid because of insufficient and inoperative disclosure.

5. The Trial Court erred in failing to enter a decree adjudging claims 1, 3, 14 and 15 of Schletter patent No. 1,713,628 to be invalid because of prior knowledge, public and commercial use by Gotham Silk Hosiery Company, Julius Kayser & Company, and/or Nussbaum Company.

6. The Trial Court erred in failing to enter a decree that the Schletter patent No. 1,713,628 is invalid because of abandonment of the invention.

7. The Trial Court erred in entering a decree holding claims 1, 3, 14 and 15 of Schletter patent No. 1,713,628 to be infringed upon by defendant's apparatus.

8. The Trial Court erred in failing to enter a decree adjudging that claims 1, 3, 14 and 15 of Schletter patent No. 1,713,628 had not been infringed upon by defendant.

9. The Trial Court erred in entering a decree awarding costs to the plaintiff.

10. The Trial Court erred in failing to enter a decree adjudging that Schletter patent No. 1,713,628 is invalid for failure of plaintiff to disclaim the subject matter of claim 10 of said patent before the suit was brought.

[fol. 921] 11. The Trial Court erred in failing to enter a decree adjudging that claims 7, 8 and 10 of the Schletter patent No. 1,713,628 are invalid.

12. The Trial Court erred in failing to enter a decree dismissing the bill of complaint.

Louis Hirsch Textile Machines, Inc., by Darby & Darby, Its Solicitors.

Dated April 18, 1936.

Citation, in usual form, omitted in printing.

[fol. 922] IN UNITED STATES DISTRICT COURT

[Title omitted]

STIPULATION AS TO CONTENTS OF RECORD

It is Hereby Stipulated and Agreed that the true transcript of record for the purposes of appeal shall contain:

[fol. 923] 1. Bill of complaint.
2. Answer.
3. Amendment to answer dated September 18, 1934.
4. Amendment to answer dated December 6, 1934.
5. Amendment to answer dated March 23, 1935.
6. Stipulation dated November 27, 1934.
7. Narrative statement of evidence at trial.
8. Plaintiff's exhibits as follows: Nos. 1, 2, 10, 15, 16, 18, 20, 24, 25, 28, 32, 33, 34, 35, 36, 37, 39, 48, 49, 50, 52, 53, 54, 56 and 57.
9. Defendant's exhibits as follows: B, C, D, E, F, H, I, L, M, N, Q, R, S, T, U, V, W, X, Y, Z, A-1, B-1, C-1, D-1, E-1, F-1, H-1, J-1, M-1, O-1, C-2, D-2, F-2 and L-2.
10. Opinion of Judge Lindley.
11. Findings of fact and conclusions of law.
12. Petition for rehearing.
13. Answer to petition for rehearing.
14. Order denying petition for rehearing.
15. Interlocutory decree dated April 13, 1936.
16. Petition for appeal and order allowing appeal.
17. Assignment of errors.
18. Citation.
19. This stipulation.
20. Stipulation as to the correctness of printed record.
21. Clerk's certificate.

It is Further Stipulated and Agreed that the following exhibits are to be treated as physical exhibits and produced in court at the argument of the appeal:

[fol. 924] (a) Plaintiff's exhibits as follows: Nos. 3 to 9 inclusive; 11, 12, 13, 14, 17, 19, 21, 22, 23, 26, 27, 29, 30, 31, 38, 40, 44, 51 and 55.

(b) Defendant's exhibits as follows: A, G, J, K, O, P, G-1, I-1, K-1, N-1, P-1, E-2, G-2, H-2, I-2, J-2, K-2.

It is Further Stipulated and Agreed with respect to Plaintiff's Exhibits 41 to 47, inclusive and Defendant's Ex-

hibits Q-1 to Z-1, inclusive and A-2 and B-2, that said exhibits need not be reproduced in the printed record herein, but that the corresponding exhibits which are reproduced in the printed record of the case of Textile Machine Works vs. Alfred Hofmann, Inc. (Plaintiff's Exhibit 3 herein) may be used in place thereof, and that the printed record in the present case shall have printed therein clear cross references as to the pages in the said record of Textile Machine Works vs. Alfred Hofmann, Inc. (Plaintiff's Exhibit 3) where said exhibits appear.

Howson & Howson, Attorneys for Plaintiff. Darby & Darby, Attorneys for Defendant.

Dated July 3, 1936.

So Ordered and the clerk is directed to certify the record in accordance with the foregoing stipulation without requiring any præcipe or any further approval by the Court or Judge.

William Bondy, United States District Judge.

Dated July 3, 1936.

[fol. 925] In United States District Court

[Title omitted]

Stipulation as to Record

It is hereby stipulated and agreed, that the foregoing is a true transcript of the record of the said District Court in the above-entitled matter as agreed on by the parties.

Dated September —, 1936.

Howson & Howson, Attorneys for Plaintiff-Appellee.
Darby & Darby, Attorneys for Defendant-Appellant.

[fol. 926] Clerk's certificate to foregoing transcript omitted in printing.

[fol. 927] UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SECOND CIRCUIT. No. 163—October Term, 1936.

Argued Dec. 14, 1936. Decided Feb. 1, 1937.

TEXTILE MACHINE WORKS, Appellee,

v.

LOUIS HIRSCH TEXTILE MACHINES, INC., Appellant

Appeal from the District Court of the United States for the Southern District of New York.

Before L. Hand, Swan, and Augustus N. Hand, Circuit Judges.

Appeal from a decree of the District Court for the Southern District of New York holding valid and infringed claims 1, 3, 14 and 15 of Patent No. 1,713,638 issued on May 21, 1929, to Richard E. Schletter.

Samuel E. Darby, Jr., of New York City, for appellant.

Dexter N. Shaw, of Philadelphia, Pa., for appellee.

L. HAND, Circuit Judge.

This is an appeal from a decree holding valid and infringed claims 1, 3, 14, and 15 of a patent for an attachment to a "full-fashioning" knitting machine by which parts of the web may be reinforced with an extra thread, or varied by an insert of "split seam work." In "full-fashioning" machines the width of the web depends upon the traverse, or "throw," of the thread carrier which brings the thread to the needles; "fashioning," which means narrowing or widening the web, is accomplished by changing this distance. The mechanism by which this is made automatically to conform with the desired pattern, need not concern us except to say that the width of the web is the distance between two stops at the ends of the machine, less the length of "carrier bar" upon which the thread carrier is fixed. This difference measures the traverse of the "carrier bar," and thus of the thread carrier. The patented attachment is to control the "throw" of secondary thread carriers, feeding other threads to the needles and fixed upon their own bars. The "throw" of these carriers is limited by stops fastened upon the carrier bars and engaging other stops carried by

two nuts, which are in turn threaded upon a reversibly threaded screw shaft. When the "throw" of the secondary thread carriers is to be changed in any way these nuts must move along the screw shaft; and if the "throw" is to be widened or narrowed their distance apart must be increased or diminished, which can be done by rotating the screw shaft. The patent is concerned for the most part with the mechanism which rotates the screw shaft at the proper time and in the proper direction. It is impossible to give a complete description of it without the aid of drawings, but enough for the purposes of this controversy may perhaps be made to appear verbally. The screw shaft is actuated by the main power shaft and its proper periodicity and rotation are secured by two endless belts carrying buttons, set at intervals corresponding with the desired pattern. One of these belts determines when and for how long the screw shaft shall rotate; and the other, its direction. At one end of the screw shaft are oppositely toothed ratchet wheels, each actuated by a pawl normally kept in contact with its wheel by a spring. The shaft is rotated by the oscillation of these pawls through a system of rods, levers and cams, leading from the power shaft. As one of the buttons on the belt [fol. 928] comes into position, by this train both pawls begin to oscillate, and if each remained in contact with its ratchet, the shaft would merely idle back and forth through an angular variation of one notch. In order to throw one pawl out of engagement and gain any increment of rotation, a separate train is necessary, controlled by the second pattern belt, which lifts the proper pawl off its wheel when the right time comes. In this way the screw shaft separates or brings together the nuts whose stops engage the stops upon the carrier bars, and limit the "throw" of the secondary thread carriers.

The four claims in suit need not be set out. Numbers fourteen and fifteen are the most detailed; they specify as elements the screw shaft ("spindle"), with its nuts, pattern control for rotating it, and another pattern control for selecting the direction. The defendant's attachment, which is used upon "full-fashioning" machines, is in general of the same character, and all the claims will read upon it without any undue extension, although the trains employed are different. Verbally the only question that could arise is because the defendant used a single pattern

belt, on which one row of buttons rotates the screw shaft and the other selects the direction. That would scarcely avoid infringement; at any rate for argument we will assume that it does not, because we think the claims invalid anyway.

Schletter filed his original application in June, 1922, and though he abandoned it later, his invention stands as of that date. Some ten years earlier the art had devised an attachment to a "full-fashioning" flat knitting machine for the construction of a pointed heel; that is, the reinforcement of the heel by an added thread beginning at a point at either edge of the web and extending inward until it reinforced its whole width. As there are no re-entrant angles in such a pattern, obviously it was only necessary that the nuts should approach during the reinforcement. This was done by mounting them on a reversely threaded screw-shaft, and when the web was finished they were "racked out" by hand to their original position. We shall call this machine the "Gotham"; it would not have been available for Schletter's purpose as it stood, and it did not therefore literally anticipate his invention. But it certainly pressed very closely upon it, and left at best a slim margin for invention; nothing indeed but the train automatically to reverse the rotation of the screw shaft by the pattern belt.

In 1917 at the Nusbaum Knitting Company of Glendale, Long Island, an attachment was made and publicly used which supplied this element lacking in the Gotham machine, though it happened to be attached to a knitting machine for making sweaters, which was not "full-fashioning," because the web for a sweater is not narrowed from top to bottom. Therefore the stops of the rod of the main thread carrier could be fixed, for the "throw" of that carrier does not change. Nusbaum made over an old "full fashioning" machine, using the existing nuts as variable abutments for stops on the bars which carried the secondary thread carriers, and supplying a new thread carrier and bar for the main thread. This bar he supplied with fixed stops at the ends of the machine, so that its "throw" was constant. The result was substantially the same thing as the defendant's attachment. The single reversibly threaded screw shaft was made into two shafts, it is true; but each of these had twin ratchets oppositely toothed, and a pawl for each ratchet. A separate train led to each of these pawls from one of four

rows of buttons upon a single pattern belt. When a button passed beneath the bell crank leading to any pawl, the crank moved a rod which in turn threw a lever into the path of a cam upon the power shaft. The rotation of this cam oscillated a second lever which in turn raised and lowered the pawl and effected a notch by notch rotation of the screw shaft. As each pawl had its own train and was out of engagement when not in motion, no other selective mechanism was necessary. For symmetrical patterns only two trains would have been necessary.

The claims in suit do not incorporate the train which connects the pawls with the power shaft, and there are many differences between the defendant's train and that of the specifications; as many perhaps as between that and Nusbaum's. The patent cannot stand upon any detail of these connections, and indeed the plaintiff does not suggest that it should; if it is valid, it is either because of the novelty of the conception of putting Nusbaum's attachment upon a [fol. 929] "full-fashioning" machine, or because of the technical difficulties of executing that conception. Of the second possibility we can dispose at once. It is indeed quite possible that there were in fact obstacles enough to call for substantial inventive capacity, but if so, Schletter did not show how they were to be overcome. With a single exception, to be noted in a moment, he said nothing at all about how his attachment was to be put on. Thus he is involved in a not infrequent dilemma of inventors, who seek to incorporate a new element into an old combination. Either the working out of the conception was so plain that it required only common-place skill, or the specifications are insufficient because they do not give the necessary directions. It seems unnecessary to labor the point, and the question comes down to the exception. It is necessary in such machines that the reversible screw shaft shall not operate while the "fashioning" stops are moving. Schletter recognized this and provided against it (Figure 11, Specifications page 4, lines 4668). The record does not advise us as to how troublesome the difficulty was, and the claims do not embody it as an element. The plaintiff has not asked us to base the invention upon it; wisely, since the solution was one which could scarcely have foiled a competent mechanic who might learn by experience of the need. Finally, we cannot take seriously the objection that Nus-

baum had two oppositely threaded shafts and Schletter had one; the Gotham machine had long since supplied that step.

The plaintiff does not indeed rest so much upon these structural differences as upon the conceptual novelty of the combination, confirmed by a great vogue once it appeared. These were the reasons for its success in Textile Machine Works v. Hofmann (D. C.) 4 F. Supp. 837, affirmed 71 F. (2d) 973 (C. C. A. 3), and in the court below in this suit. Its argument follows familiar lines. If it was so easy to combine the earlier elements, why did the art wait so long? The need was not new; no technical obstacles had stood in the way; success was sure to bring substantial gains. The combination should have appeared much earlier, if it lay open to ordinary talent. We have ourselves often reasoned so, for the history of an art before and after the putative invention appears, is the best test when it is available. But it is a dangerous test to apply, and will lead one astray unless jealously watched. Here for example there were only five years at most between the appearance of Nusbaum and Schletter's filing date; that is not a long period, and there is no evidence that people had meanwhile turned their minds to the matter, such as is found at times in intervening unsuccessful patents. Again it is not shown that Nusbaum's attachment had become widely known. Though it was in "public use," that presupposes no real publicity; so far as appears, it made no impression on the art. Yet in estimating Schletter's invention we must assume that it was known to everyone. It does indeed seem as though clocking or other inserts in cheap hosiery, must have been desirable for a good while before 1922, but one can never be sure; industry is often extremely sluggish and there may have been technical or industrial reasons of which we do not know. Nor are we told by what means the attachment has achieved its success; for all that appears it may have come into strong hands, especially able to exploit it. These gaps in the evidence we are asked to fill in and make a conclusion contrary to the most imperious claims of commonsense; we are to hold that an art which knew how to reinforce "full-fashioned" webs without re-entrant angles, and straight edged webs with such angles, required some uncommon talent merely to conceive of combining the two, for, as we have said, the patent can only stand on the bare

conception. Surely that is incredible. It may be that the introducer, the popularizer, of a new and valuable variant, should gather the profits; perhaps any new use should be enough. But the law is not so; we must find a touch of something beyond the ruck of ordinary craftsmanship, either in conceiving a new need, or its satisfaction, or in contriving the means; nothing else will serve.

Since we think the claims invalid for want of invention, we need not consider the other defences.

Decree reversed; bill dismissed.

[fol. 930] UNITED STATES CIRCUIT COURT OF APPEALS, SECOND CIRCUIT

At a Stated Term of the United States Circuit Court of Appeals, in and for the Second Circuit, held at the United States Court House, in the City of New York, on the 8th day of February, one thousand nine hundred and thirty-seven.

Present: Hon. Learned Hand, Hon. Thomas W. Swan, Hon. Augustus N. Hand, Circuit Judges.

TEXTILE MACHINE WORKS, Plaintiff-Appellee,

vs.

LOUIS HIRSCH TEXTILES MACHINES, INC., Defendant-Appellant

Appeal from the District Court of the United States for the Southern District of New York.

This cause came on to be heard on the transcript of record from the District Court of the United States for the Southern District of New York, and was argued by counsel.

On Consideration Whereof, it is now hereby ordered, adjudged, and decreed that the decree of said District Court be and it hereby is reversed with costs and with instructions to dismiss the bill.

It is further ordered that a Mandate issue to the said District Court in accordance with this decree.

Wm. Parkin, Clerk.

[fol. 931] Endorsed: United States Circuit Court of Appeals, Second Circuit. Textile Machine Works vs. Louis Hirsch Textile Machines, Inc. Order for Mandate. United States Circuit Court of Appeals, Second Circuit. Filed Feb. 8, 1937. William Parkin, Clerk.

[fol. 942] UNITED STATES CIRCUIT COURT OF APPEALS, FOR THE SECOND CIRCUIT

TEXTILE MACHINE WORKS, Appellee,

against

LOUIS HIRSCH TEXTILE MACHINES, INC., Appellant

Before: L. Hand, Swan and Augustus N. Hand, Circuit Judges.

ON PETITION FOR REHEARING

Howson & Howson for the Petition.

PER CURIAM: Petition denied.

U. S. Circuit Judges.

Filed, Mch. 2/37.

[fol. 943] UNITED STATES CIRCUIT COURT OF APPEALS, SECOND CIRCUIT

At a Stated Term of the United States Circuit Court of Appeals, in and for the Second Circuit, held at the United States Court House, in the City of New York, on the 2nd day of March, one thousand nine hundred and thirty-seven.

Present: Hon. Learned Hand, Hon. Thomas W. Swan, Hon. Augustus N. Hand, Circuit Judges.

TEXTILE MACHINE WORKS, Plaintiff-Appellee,

vs.

LOUIS HIRSCH TEXTILE MACHINES, INC., Defendant-Appellant.

A petition for a rehearing having been filed herein by counsel for the appellee; upon consideration thereof, it is ordered that said petition be and hereby is denied.

Wm. Parkin, Clerk.

[fol. 944] Endorsed: United States Circuit Court of Appeals, Second Circuit. Textile Machine Works vs. Louis Hirsch Textile Machines, Inc. Order. United States Circuit Court of Appeals, Second Circuit. Filed Mar. 2, 1937. William Parkin, Clerk.

[fol. 945] UNITED STATES OF AMERICA,-SOUTHERN DISTRICT OF NEW YORK

I, William Parkin, Clerk of the United States Circuit Court of Appeals for the second Circuit, do hereby certify that the foregoing pages, numbered from 1 to 944, inclusive, in 2 volumes, contain a true and complete transcript of the record and proceedings had in said Court, in the case of Textile Machine Works, Plaintiff-Appellee, against Louis Hirsch Textile Machines, Inc., Defendant-Appellant, as the same remain of record and on file in my office.

In Testimony Whereof, I have caused the seal of the said Court to be hereunto affixed, at the City of New York, in the Southern District of New York, in the Second Circuit, this thirtieth day of April, in the year of our Lord one thousand nine hundred and thirty-seven, and of the Independence of the said United States the one hundred and sixty-first.

Wm. Parkin, Clerk.

[fol. 946] SUPREME COURT OF THE UNITED STATES

ORDER ALLOWING CERTIORARI—Filed June 1, 1937

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Second Circuit is granted. And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

[fol. 947] IN SUPREME COURT OF THE UNITED STATES

STIPULATION AND ADDITION TO RECORD—Filed July 20, 1937

It is hereby stipulated between the Petitioner, by its attorney, and the Respondent, by its attorney, that in reprinting the Record in the above-entitled cause, the Clerk shall include, in addition to the Record as submitted with the Petition for Writ of Certiorari, the following documents and papers, to-wit:

The testimony set forth on pages 152 to 205 inclusive in Volume I of Plaintiff's Exhibit 3 (the printed transcript of record prepared by the Clerk of the Court of Appeals for the Third Circuit in the suit of Alfred Hofmann, Inc. vs. Textile Machine Works, No. 5312, March Term, 1934)

Defendant's Exhibit Q-1 as reproduced on pages 489 to 497 inclusive of Volume II of said Hofmann Record, Plaintiff's Exhibit 3, (offered at page 292 in the Record of this suit)

Defendant's Exhibit V-1 as reproduced on pages 507 to 513 inclusive of Volume II in the said Hofmann Record, Plaintiff's Exhibit 3 (offered at page 294 in the Record of this suit)

[fol. 948] Defendant's Exhibit Y-1 as reproduced on pages 523 to 541 inclusive in Volume II of the aforesaid Hofmann Record, Plaintiff's Exhibit 3 (offered at page 296 of the Record in this suit)

Defendant's Exhibit T-1 offered at page 293 of the transcript of record in this suit, (the same being Defendant's Exhibit BB, offered at page 239 of the aforesaid Record in the Hofmann suit, Plaintiff's Exhibit 3 herein), a photostat print of said exhibit being hereto annexed and marked Defendant's Exhibit T-1

Defendant's Exhibit B-2, offered at page 296 of the Record in this suit, (the same being Defendant's Exhibit O, offered at page 188 of the aforesaid Record in the Hofmann suit, Plaintiff's Exhibit 3), a photostat copy of which is hereto annexed and marked Defendant's Exhibit B-2.

True duplicates of all of said documents and papers are filed herewith, and the Clerk is requested to include the same in the printed Record herein, in accordance with this stipulation.

Hubert Howson, Attorney for Textile Machine Works, Petitioner. Samuel E. Darby, Jr., Attorney for Louis Hirsch Textile Machines, Inc., Respondent.

July 15, 1937.

[fol. 949] ELMER R. ROTH, called on behalf of the defendant, being duly sworn, testified as follows:

Direct examination.

By Mr. Darby:

My age is thirty-eight. My residence is 2 Elm Street, Dover, N. J. I am in attendance at the trial of this case by reason of subpœna. My occupation is that of a full fashioned knitter. I am employed by Gotham Hosiery Company in their Dover, N. J., plant. I have been employed by Gotham ever since they took the plant over at the end of 1927. The plant was owned at the time it was taken over by [fol. 950] Gotham by Onyx Hosiery Incorporated. I was with Onyx from the time that it was changed over from Paul Gunther, Incorporated. I don't have the date. The Onyx Hosiery Company took over the company of Paul Gunther, Inc. I was employed by Paul Gunther, Inc. I first entered their employ some time in September, 1916. I was continuously in their employ until the time it was taken over by Onyx. I was continuously in the employ of Onyx until it was taken over by Gotham. I still am in the employ of Gotham.

I first went with the Gunther Company in the capacity of a full fashioned knitter. I worked on the full fashioned knitting machines. My work is still the same.

I have not been working on the same machines throughout that period of time. Approximately eight years I

worked on the same type of machines, that is on Richter 39 gage machines. That was beginning in 1916 to sometime in 1924. When I went to work with this Richter machine, when I started my work on this Richter machine there were fourteen that I know of of that special type at the Gunther plant.

When I first went with the Gunther Company, Heyde, I believe, was the foreman at that time. Mr. Heyde is here in the courtroom. A man by the name of Nobus succeeded him as foreman. Nobus is in the courtroom. Paul Gunther succeeded Nobus. Mr. Paul Gunther is here in the courtroom. At the present time my foreman is Walter Peters.

The Gotham Company still has got one of these original Richter machines that I worked on. I can identify this as the attachment that we used on those machines to make the pointed wedge heel, as they called it at that time. This is either a machine that I worked on or one just like it. I don't know if it is the same one or not, I couldn't say.

[fol. 951] (The attachment for the machine referred to was put on the small table in front of the Court's bench.)

(The witness stepped down by the machine.)

The type of knitting machine this attachment was on was a Richter machine. That was a flat type Richter machine.

Q. 35. Will you describe this machine, perhaps we can make it quicker if I do it this way. What is this threaded member at the end of the machine, what did you term it in your work?

A. Well, that is a spindle with a right thread on one side and left thread on the other side. That is, the attachment had a spindle. It had a spindle at the other end with reverse thread. The completed machine on which this attachment was mounted was approximately, at that time—18-section machines—were possibly twenty-eight to thirty feet long. Just one attachment was provided on the complete machine. The attachment was situated not at the end, and it was not in the center, it was a little bit off the center of the machine. Between the ends.

These rectangular rod members are what they term the carrier rods. Those carrier rods extended the complete length of the machine, but they were joined, they were in two sections, and joined by a coupling mechanism. They

were joined so that both sections would move together. They would move at the same time, the same operation.

This mechanism that appears to be mounted on the spindle is a nut that would move this block either in or out to start from a point and widen out, to shape the pointed heel. The pointed heel is a reinforcing thread on the stocking.

It will be noticed that there are two of the devices you call [fol. 952] nuts, one on each spindle. The spindles are connected together here (indicating), to make it one and move the whole spindle at the same time, when the spindle moves in one direction one nut moves to the right and one to the left toward each other. When the spindle is moved in the opposite direction the nuts move in the opposite direction.

As to the mechanism here that consists of a gear wheel mounted on the spindle in mesh with a beveled gear and square headed stud. I will say that these gears were for the purpose of resetting these nuts to again start to make the pointed heel. When the nuts had approached together as closely as it was desired or necessary to have them do so you would then manually reset the nuts back to the proper position for starting another operation. We would do that by hand.

Q. 56. Will you demonstrate how you could turn those nuts from their present position?

A. (Witness demonstrates by running machine.) You can turn this out, and then one nut moves to the right and the other one to the left to reset it and again start to make the next step.

When I started to reset the nuts I moved a pawl out of the way. That pawl is on a ratchet apparatus that works from the cam shaft in order to move this spindle and again rack these nuts in to make this pointed heel. This is done while the knitting operation is going on, that is, while the machine is in operation. You could rack out the nuts while the machine was in operation.

Ordinarily we would wait until we were pretty near ready to again start to make the pointed heel and we would rack it out, set it in proper place. The mechanism employed for turning the spindle while the machine was in operation was this hand crank. That is, for racking it out. When the nuts were moving towards each other the mechanism employed for actuating the pawl, was as follows:

[fol. 953] There was an arm in back of the machine which was connected with another arm that operated a roller on

the cam. This cam had a flat side. When the shift was to take place this arm would drop on that flat side and as the cam shaft came around and the cam come to the high side it would push this ratchet apparatus and work the spindle.

I recognize the photographs that are handed me. In the first photograph is shown this same apparatus that is the attachment that we have here on the table. It is attached to a machine in this figure. The yarn guides are shown in the picture. The section of the photograph immediately beneath is another view of the same apparatus. The third photograph also is a view of that apparatus. In the fourth photograph is shown the pattern chain and the lever which operated this arm on the cam shaft. This pattern chain controlled the operation of the rotation of the spindle by these buttons that are shown here on the chain. When one of these buttons would come around to this lever it would automatically lift it away and thereby let the machine operate the spindle.

The last photograph is another view of the same mechanism taken in perspective. That is a view of the entire pattern chain as it looked on the machine. These photographs show the machine with attachment.

The attachment here in court is identical with the apparatus that I worked on from 1916 on. That is identical with what I worked on.

Mr. Darby: I offer the pamphlet containing the photographs in evidence.

The Court: It will be admitted.

(Pamphlet received in evidence and marked Exhibit D-C.)

[fol. 954] Q. Will you point out on the Court's copy of the photograph the mechanism that operates the spindle, to rotate it?

A. Yhy, yes.

The Court: Just mark it with a pen. Mark an "X" at the point.

The Witness: Here is one view of it (indicating). This is the cam.

Mr. Darby: I will mark the cam "A."

The Witness: And this is the roller up here (indicating).

Mr. Darby: Mark that "B."

The Witness: And this is the arm that goes up in back of the machine.

Mr. Darby: Mark that "C."

The Witness: To operate this arm. This is about half the length that it was with the other part connected onto it. I believe over here (indicating) is a better view of the arm that that roller is attached to. This arm here (indicating) is the same as what this roller is attached to here, "B."

Mr. Darby: We will letter that "D" on the next photograph.

The Witness: The machine was a full fashioned machine that this apparatus was attached to. The mechanism for fashioning, that is narrowing and so on, to fashion the stocking, was at each end of the machine. It had no connection with this attachment whatever. The narrowing mechanism consisted of a short spindle with a thread on, similar to this. It was a short spindle and at the other end was a short spindle with a reverse thread, and that fashioned when it narrowed the work off of the main cam-shaft, and fashioned [fol. 955] the stocking in the narrowing. Each of those spindles had a traveling nut on it.

Q. 85. What mechanism was employed in the machine for rotating the spindles so as to cause the nuts to move?

The Court: These are the end ones of the compact mass?

Mr. Darby: Yes.

The Witness: There was a cam provided on the end of the cam shaft at either end of the machine with a roller and arm that controls that pawl movement of those spindles on either end of the machine. A pawl similar to that one (indicating). And a ratchet tooth similar to this ratchet tooth at each end.

A separate chain with buttons provided for actuating the narrowing mechanism. There was a chain which if started at the proper time would work this automatically.

Q. 89. And that chain was separate from the chain which I will number E in the photograph?

A. Right. That was altogether separate.

Q. 90. I hand you a pair of stockings and ask you if you recognize those stockings?

A. That looks like the stocking that we used to make when I first came with Paul Guenther, Inc., with the pointed heel into them, made by this attachment here.

Mr. Darby: I ask to have the stocking marked for identification.

(Received and marked Exhibit D-C, for identification.)

That pointed heel was effected by plating or reinforcing thread. That was plated in at that time in all ingrain work. That is ingrain work.

[fol. 956] The function in this attachment of these pivoted arms was as follows:

The idea of these pivoted arms was when not in use we could lay them back out of the way. When in use we would simply bring them forward again, and when this was set these stops would hit on there to stop the carrier from going the entire width of the fabric. These were the same stops in use and employed by me since 1906. We never did have occasion to cause the nuts in the spindles to be moved backward, other than in racking it out entirely. The reason was that I do not think there was any demand for goods of that nature, at that time. If it was desired to have the nuts move outwardly, I would know how to do it.

Q. 98. How would you do it?

Mr. Howson: I object. He is asking a conclusion or hypothetical question of the witness which is not competent.

The Court: Is the question directed to how the machine would operate if they were to be moved outward? How it would have operated if connected to the knitting machine?

Mr. Darby: Yes.

The Court: I think I will permit it.

Mr. Howson: He is asking the witness what changes he would have to make in the device if he wanted to do something else with it.

The Court: If that is so it would be different. I understand it is as to what he would have to do manually to accomplish it in connection with the machine.

Mr. Howson: If that is the case, I have no objection.

[fol. 957] A. In that case, if we had to make a style where we had to move them the other way, the only way we could do it would be to lift the dog and set it by hand every time there was a shifting to take place, and set it at the next one.

Cross-examination.

By Mr. Howson:

X Q. 99. Mr. Roth, what was your name for these stockings which have been marked for identication Defendant's Exhibit C?

A. They were ingrain work of the Pointex type.

X Q. 100. Did you have any name for this attachment?

A. That was what we termed the Pointex Attachment.

X Q. 101. Now, in making this Pointex reinforcement, as shown in this exhibit marked C, how many carrier bars were used in laying the reinforcing thread?

A. In laying the reinforcing thread?

X Q. 102. Well, the thing that made the Pointex.

A. One on each one.

X Q. 103. And in doing that work, how did you have the abutments arranged on the carriers. Did one of the carrier bars—was it stopped on its inward motion by one of these stops and on the outward motion by the regular stop on the machine?

A. On the end. Correct. The other carrier was controlled the same way on the opposite side. I did not say that we are still using these attachments, not that identical attachment. We are not still making the Pointex heels. We are making modified heels. That is a heel that starts in a square straight narrow form and moves that way (indicating) and then it narrows out wider. I am at the present time using a Lieberknecht high-speed machine to make those [fol. 958] stockings on. The agents for that machine in this country I believe are Alfred Hofmann, Inc.

As to whether that machine has any attachment on for controlling the carrier bars and auxiliary attachment for controlling the carrier bars, in addition to the end stops of the machine I will say that the stops on that machine are in the center, and it has an additional attachment on to control the stops on the carrier bars. That attachment works much on the same principle as this one. In the case of that attachment you do have a reversely-threaded spindle. I believe it is arranged to work automatically in both directions, although I never worked it. According to my best recollection I believe that attachment has the automatic reverse. We have had that attachment about two and one-half years. So far as these old attachments that we have been speaking of, they are not in use in the mill at all today. Those machines that had those on were worn out in the meantime. The attachments were not worn out. They possibly could have been used on other machines. I do not know whether they would fit on other machines. We did not try to fit them on. Not to my knowledge. The reason might be because machines began to come in with other attachments. This modified stocking that I was speaking of

certainly could be made on this attachment which I have produced here. That is a reinforcement in which the stop nuts on the attachment only have to be moved in one direction.

We make cradle foot stockings in our mill. I could not tell you what attachment we use in making those. I am a legger. I do not know. That is made on footing machines. There are some footer machines right close by the legger machines, but I never bothered about them. I just pay attention to my job.

I do not know if there has been any shadow clock made in our mill or not. I do not know what attachment they would be made on. I do not know whether they would be made [fol. 959] on this device that has been produced.

Redirect examination.

By Mr. Darby:

I believe I said the more recent machines are Lieberknecht high-speed machines. They call them high-speed machines because they operate at 60 or 65 courses a minute. The older machine used to operate about 40, 41 or 42 courses a minute. Those new machines come complete with attachments. I am working on the Lieberknecht high-speed machine.

I said in answer to a question asked me by Mr. Howson that I believe the machine can automatically reverse, but I have never used it. I do not know just why. We have no orders for any work of that kind. That is the only reason that I could give.

Recross-examination.

By Mr. Howson:

I am not making the foot. I am just making the leg. That is all.

Paul Guenther, called and sworn on behalf of the defendant, testified as follows:

Direct examination.

By Mr. Darby:

I am forty-two. I reside at Dover, N. J. I am employed by the Gotham Silk Hosiery Company. My job there is

foreman in the knitting department. I was employed by the Guenther Company since 1913, in April.

When I was employed by the Guenther Company I at once became familiar with the machines they were using at that time. I was a full fashioned hosiery knitter at that time.

[fol. 960] I have heard the testimony that has been given about the machine that is here in the Court.

Mr. Darby: I offer this attachment in evidence at this time.

(Received in evidence and marked Exhibit D-D.)

I am familiar with the construction of this machine. One or more machines with the attachment like Exhibit D was in use at the Gunther plant at the time I entered their employ. I worked on the footer. On the Richter footer.

The Court: He said he used this type on the footer.

The Witness: No, sir; Mr. Darby said if I worked on the type machine like that. I said not on the legger, on the footer.

The Court: But with this type machine.

The Witness: This type.

The Court: You used this type of attachment, did you?

Q. 14. Was this attachment on the footer machines?

A. No, sir. It was only on the leggers at that time.

I was in the Gunther Company until the time it was taken over and since that time, and I am in the firm yet. I worked with Gunther until it was taken over by Onyx and stayed with Onyx until it was taken over by Gotham, and I am still with Gotham. Throughout that period of time these machines were used continuously. At that time I was there there was fourteen machines. And they were used continuously right up until they stopped them some couple of years ago, I don't know exactly, but since that time they were installed, they have been working all the [fol. 961] time since that time, they have been set up, they have been worked steady. I recognize this machine as one of the machines. That has been continuously in use since 1913 or 1914 or thereabouts. It was not only finished in 1913 when I came there. They were not all finished. That is, all fourteen were not finished. As to about when all

fourteen of them were in operation I don't know exactly, about the end of 1913, I think, something like that.

These machines were used in the normal work of making stockings for sale, that is, they were used steadily for turning out stockings, which were sold by the company.

I recognize these photographs handed me. Shown on Defendant's Exhibit C. Those photographs are of the Richter machine. I was made foreman of the department in which these machines were operating. That was the end of 1921.

Q. 39. Do you recognize the pair of stockings which I hand you which has been marked Defendant's Exhibit C for identification?

A. Yes, that is the type of stocking we was running that time.

Mr. Darby: That is all.

Mr. Howson: No cross.

(No cross-examination.)

FRANK HEYDE, called on behalf of the defendant, being duly sworn, testified as follows:

Direct examination.

By Mr. Darby:

I live in Brooklyn. I am fifty-one years old. I am employed by Julius Kayser Company but I am out of work just now. I was last employed by Julius Kayser Company. [fol. 962] Their business is hosiery manufacturing. I was employed by the Gunther Company. I was also employed by the Richter Company from August, 1912, in Germany and they sent me over here to this country for putting up their machines. The first place that I went to put up the Richter machines on my arrival in this country was at Paul Gunther, Dover, N. J.

I recognize this attachment, this Defendant's Exhibit D here in the courtroom. It is a pointex, we called it at their place at Dover, N. J., we call it a pointex attachment. At the Gunther place. This was not part of the equipment that I installed in the first couple of machines. The first

few machines, I believe it was four or five, maybe six machines, they came without, but all the rest they was with it, with that attachment. The first five or six machines were without this attachment and all the rest with the attachment. As much as I can remember there was fourteen in all.

I did not continue in the employ of Richter. I left Richter and went over to Mr. Gunther. He took me over I think in 1913. I continued to work with Gunther from that time on until about the end of 1918. I was foreman there. Till 1918. I left Gunther. Then I went to Julius Kayser in Brooklyn.

I did not personally with some assistance of perhaps other men personally install all of those fourteen machines. I was there until they all was finished.

Q. 31. And you had charge of the installation of them all?

A. I had not charge over it but after I took a job as a foreman then I had charge over it.

The Court: The installation, who installed them for the Richter Company, somebody else with you?

The Witness: Yes.

[fol. 963] Q. 32. You and somebody else installed all of those machines?

A. There was more than me.

Mr. Darby: Yes.

The Court: Were you in charge or someone else in charge?

The Witness: Well, each you know everyone was working independent from each other at that time.

Q. 33. As I understand it, Richter sent over a number of men of which you were one to install these machines, is that right?

A. Only you know we was working by ourselves.

Q. 34. I understand that, but what I am interested — now is did you install all of these fourteen machines?

A. No.

Q. 35. Who did?

A. Mr. Nobis, then there was another one, I think it was Fenwick.

Q. 36. But you know that all fourteen of them were installed?

A. They were not installed, no.

Q. 37. All fourteen machines were working there, weren't they?

A. Yes, in 1913.

I had something to do with putting out some of them, if not all, and Mr. Nobis and perhaps other people had something to do with some of them too. Some four or five machines didn't have attachments on as we put them up. Attachments were later put on those machines too. I think it was either in 1915 or 1916. The whole fourteen machines finally had the same attachment like this Defendant's Exhibit D. They had them all on later.

[fol. 964] I recognize the photographs of Defendant's Exhibit C as photographs of the attachments on machines. That I installed, that I erected.

I never went back to Gunther or Onyx or Gotham.

I was made foreman in 1913. I continued as foreman from 1913 on until I left in 1918.

At the time I left in 1918 I think we had fourteen machines with attachments of this type. As part of my job I had to keep those machines in working order and repair them when repairs were necessary.

Those machines were employed, to my knowledge, for the manufacture of stockings of the company in the regular course of business.

Mr. Darby: That is all.

Cross-examination.

By Mr. Howson:

I didn't have anything to do with making stockings—operating machines for making stockings. I had charge over the machines. I didn't operate them. I first saw these photographs, I am referring to Exhibit C, just lately, I think one or the other day. I did not have anything to do with taking the pictures. I don't know where they were taken. I said I recognized them as showing the old attachments at the Gunther mill that Mr. Darby was asking me about because I think we had only one kind on the Richter machine. And that is the kind that is shown in these pictures, exactly the kind we had there.

[fol. 965] FRANK NOBIS, called on behalf of the defendant, being duly sworn, testified as follows:

Direct examination.

By Mr. Darby:

I live in Brooklyn. I am fifty-five years old. I worked the last time by Hofmann's Corporation. They are the manufacturers of textile machinery. Knitting machines, full fashioned hosiery machines. That was about two years ago.

The Court: How long ago was your last employment with them, that is the first question.

The Witness: That is about two years now, see.

Q. 10. Two years?

A. Yes. I have been employed by the Gunther Company in connection with installing some machinery, knitting machinery. That was in 1912. That was the Richter machine. At that time I start erecting that kind of machines there was another fellow here. I comes over here, see. I was joined by Mr. Heyde. He comes six weeks later. The first couple of machines did not have attachments. I erected the machines, see, the Richter machine, he comes later with that pointex attachment. I mean this attachment shown in Exhibit D. We erected the same Richter machines with that attachment. I erected more than one machine with this attachment. I start to work at the Gunther plant first of August, 1912, and I go 1913, June the 5th.

When I left about eight Richter machines had been erected. About half of those eight machines had this attachment, an attachment like Exhibit D. I saw those machines in operation. With that attachment. I have been back to Gunther since then. I be back to Gunthers since 1919. I saw those machines that I had installed then. As [fol. 966] to how many Richter machines were there then I will say we have on that floor I got the charge over, we got fourteen machines. With that attachment all working. All fourteen machines with attachment were working in 1919. When I went back to work with Gunther. My job with Gunther when I went back in 1919 was that of foreman in charge of these machines. I had charge of other machines. There were fifty-nine more machines there.

Q. 41. Were all of those machines employed for making pointed heels?

A. Well, different kinds of machines with pointex.

I left Gunthers in 1922. I have not been back since. I have never been employed by them since. From the time that I went back in 1919 to 1922 these machines were kept in operation turning out stockings with pointed heels.

Mr. Howson: No cross-examination.

(No cross-examination.)

Max Gruner, called on behalf of the defendant, being duly sworn, testified as follows:

Direct examination.

By Mr. Darby:

I am thirty-five years, I live at Dover, N. J., I am assistant superintendent of the Gotham Silk Hosiery Company. I have been employed by the Gotham Company since they took it over since 1926.

I was employed by the Gunther Company. I was in charge of the order and silk department. I went with Gunther in 1916. I continued with Gunther until it was taken over by Onyx. I continued with Onyx until it was taken over by Gotham. I have supervision over the records of the Gotham Company. I have been able to obtain [fol. 967] from the original records of the Gotham Company data pertaining to the purchase of certain machines from Richter.

Q. 10. Will you tell me when those machines were purchased from Richter?

The Court: Is the knitting machine and the attachment—are they both Richter's?

Mr. Darby: Yes, sir.

The Court: So that this is not the only Ritcher proposition, the machines themselves, the knitting machines themselves were Richter's too, were they?

Mr. Darby: That is my understanding.

Q. 11. Is that right, Mr. Gruner?

A. Yes.

Mr. Darby: As I undersand it, your Honor, that has been the practice in this industry from the very beginning.

The Court: Well, we have sort of referred to this machine as a Richter machine and I didn't know the knitting machine itself was a Richter machine too.

Mr. Darby: It is a Richter built Cotton machine.

The Court: I see, all right.

A. I have records in my file from June the 23d, 1913, when machines was invoiced when they arrived in this country at the company. They were Richter machines, Richter leggers. On that invoice there was one machine. I was able to find the invoice for the other Richter machines in my file. This invoice identifies the machine by number—by the manufacture and number. The machines were bought from the agent's spindler.

[fol. 968] I found in my records data bearing on the erection of the machines and men being sent for the purpose of erecting machines. I have the letter which states the time when Mr. Heyde started, was sent over here to erect machines. The date of that letter is August 26, 1912.

Mr. Darby: I offer photographic copy of the letter in evidence. You don't mind photographs in place of the originals?

Mr. Howson: No.

(Photograph received in evidence and marked Defendant's Exhibit F.)

Mr. Darby: I offer in evidence photographic copy of the one invoice that was produced by the witness.

(Photograph received in evidence and marked Defendant's Exhibit G.)

Mr. Darby: I might state to the Court and Mr. Howson rather than cumber up the record I am merely producing one in each instance rather than going through them all.

The Witness: I have got a record of the employment of Paul Gunther. Paul Gunther was employed April 1, 1913. I likewise have got our original record of employment of Elmer Roth. Elmer Roth was employed September the 13th, 1916.

Mr. Darby: I offer in evidence a photographic copy of the employment record pertaining to Paul Gunther.

(Photograph received in evidence and marked Defendant's Exhibit H.)

Mr. Darby: I offer in evidence a photographic copy of the employment record of Elmer Roth.

[fol. 969] (Photograph received in evidence and marked Defendant's Exhibit I.)

Q. 22a. Is there any connection between the invoice of E. O. Spindler which is in evidence as Defendant's Exhibit G and the attachment which is here in the court room marked as Defendant's Exhibit D?

A. Yes, the invoice states that the pla-ted wedge heel was sent with the machines.

Q. 23. And can you identify, is there any way by which you can identify this particular plaited wedge heel as being the one which this particular invoice was for?

A. Well, it was sent, it was known at that time by the, as a so-called wedge heel. The pointed heel was really only given by Paul Gunther, Inc., they called it Pointex heel.

The Court: If you can identify by your records this particular machine that is here, by number or anyway that you can see whether this machine was the one spoken of in that invoice.

Q. 24. Were the machines given numbers by you?

A. They were given numbers, yes.

Q. 25. What was the number that was given to this machine?

A. The manufacturing numbers were numbered by our own numbers which was numbered 210. I know what attachment that is here in the court room. It is a pointed heel, Richter pointed attachment. The number is 210. In other words, this attachment is the attachment for which Exhibit G is the invoice.

I produce one of our early invoices for stockings made on this Richter machine with attachments. I identify the original invoice with this photograph that is handed to me. On November 25, 1916, there was style 366, known by our number 298—forty-four dozen were sent on that invoice.

[fol. 970] Mr. Darby: I offer in evidence a photographic copy of that sample invoice.

(Received in evidence and marked Exhibit D-H.)

Q. 33. I call your attention to some photographs, Defendant's Exhibit C. Were you present when those photographs were taken?

A. I was. They were taken, approximately about three weeks ago. The number of the machine, that was being photographed, was our No. 210. A 39-gauge Richter legger. I was present when Defendant's Exhibit D was taken off of the machine. It was the attachment that was on the machine that was photographed, and taken off later on. That is the attachment.

Mr. Darby: That is all.

Cross-examination.

By Mr. Howson:

I would say we have about ten of those attachments still in our mill. Some are still on the machines. Some are on and some are off. Those that are off are just laying idle. We never made any effort to sell them to my knowledge.

X Q. 43. Well, where are they? Where do you keep things of that kind in the mill? Is it a junk place?

A. It is not a junk place. It is a place where machines which have been worn out—and those attachments are also worn out—they are still at the place to be kept.

I say some of the attachments are still on the machines. We just have not bothered to take those attachments off of the machines. The machines stand as they have been stopped. The machines have not been operated for several [fol. 970a] years. They have been superseded by other machines.

Mr. Howson: I guess that is all.

Redirect examination.

By Mr. Darby:

R. D. Q. 47. These other machines that you have referred to are the high-speed machines?

A. All machines which come in are high-speed machines.

Mr. Darby: That is all. I will now take up what is known as the Kayser use. I think that concludes the Gotham. I will call Mr. Mutchler.

ARTHUR W. MUTCHLER, called and sworn as a witness on behalf of the defendant, testified as follows:

Direct examination.

By Mr. Darby:

I am forty-seven years old. I am superintendent of the hosiery department of Julius Kayser. I have been in the hosiery business since 1920. I was first employed by Julius Kayser as a full fashioned knitter.

We employed a Ludwig machine at that time for knitting full fashioned hosiery. I worked on it. They had two Ludwig machines that made pointed heels. They put on attachments later. I think the attachments were put on in 1923. I made pointed heels at the time I first went with the Kayser Company on two machines. The pointed heels were made on the two machines with a ratchet attachment. Those two machines came with the attachment. This ratchet attachment was located on the end of the machine. [fol. 971] That attachment was not part of the narrowing mechanism. It was in addition to the narrowing mechanism.

That attachment for making the pointed heels that I was working on at that time was a ratchet attachment. A cam mechanism was provided for rotating the ratchet. When you rotated the ratchet the cam would lift an arm and move the ratchet in. That would leave your carrier follow in on the ratchet.

The Court: What was the carrier? What do you call the carrier?

The Witness: The thread carrier.

The ratchet was mounted on a casing over your carrier rods. The ratchet was not mounted on a spindle, or a shaft of any kind; that was not a spindle attachment. We were equipped with a spindle attachment, on other makes of machines there were spindle attachments. These other makes of machines were the Carl Lieberknecht. I was familiar

with that machine. I worked on one of those machines. That Lieberknecht machine was likewise a full fashioning machine. It also made pointed heels. We had a spindle attachment which enabled us to make pointed heels. The spindle was a reversible screw. Right and left thread screw. That was located in what they call the first section of the machine. That is, between the ends of the machine, but nearer one end than the other. I did not work on that particular machine. I worked on a machine like it while I was with Kayser.

I was familiar with that particular machine from the time I first went in their employ. Kayser had two machines of that type with the original attachments on at that time to my knowledge. I have continued in the employment of Kayser from that time to the present time. Kayser has only one of those machines at the present time. They scrapped the other one for the reason that it was [fol. 972] worn out. The one that we still have is not in operating condition; it has not been worked for two years. But up to two years ago that machine was working in manufacturing stockings for sale.

I am handed some photographs and asked if I can identify the machine as shown in these photographs. I will say yes, this attachment is on the machine. That machine shown in these photographs is known as shop number 64. That is the Lieberknecht machine which I stated is still at my factory. It is either on that machine or a machine like it that I worked. There are two nuts provided for the reverse threads of the spindle. I will point them out and mark them. This one is marked "A." The other one is marked "B." And we will mark them *and* "A" and "B" on the second photograph and "A" and "B" on the third photograph.

The cam motion from the main cam shaft caused the spindle to rotate. As to what controlled, when the cam would be made operative so that the spindle could operate, I will say that there was an idler wheel on there with studs. The idler wheel would move six courses and drop your pawl in your ratchet to move your spindle. Those studs constituted a pattern which determined when the rotary movement would be imparted to the spindle. That mechanism came equipped so that you could change the pattern at will. You could change those studs. When the spindle

was rotated in one direction the nuts would travel toward each other. The spindle was power-operated in one direction. It was not power-operated in the reverse direction. You would rack it out by hand. By a small wheel on the end. You would turn that back. You could do that by means of the handle which I will mark "C."

Mr. Darby: I offer the photograph in evidence.

[fol. 973] (Received in evidence and marked Exhibit D-J.)

The Witness: I know Mr. Hockin. I also know Mr. Hecker. They have been employed by the Kayser Company while I was employed there.

I am testifying under a subpœna in this case.

Mr. Darby: That is all.

Cross-examination.

By Mr. Howson:

The Witness: I have been at the Kayser mill since 1920. In that time there were seventeen attachments like that shown in the photographs which Mr. Darby had me identify that were in actual use in the mill. None of them are in use at the present time. The machines were scrapped. The whole thing was scrapped. There is only one machine there. That is not in use. It is not in a museum. It just stands on the floor.

We are not making Pointex heel stockings at the present time. We made some for export I think last November. We used Schubert and Salzer machines in making those. There was an attachment on that machine for doing the pointed reinforcing work. I cannot say the exact date of those machines. They were purchased from Alfred Hofmann, Inc. That machine has a spindle attachment. We only worked that spindle automatically in one direction. There is mechanism on some of the machines for working it automatically in both directions if you choose to do so. But in making the Pointex heels we would operate it only in one direction automatically.

We have some Reading machines there. I recall that in February, 1929, there were purchased for the Kayser Mill, four Reading machines which had the attachment for reinforcement. With the reverse spindle attachment. I think

[fol. 974] that was before we secured the Schubert and Salzer machine with that attachment.

We are not making any shadow clock stockings. We have not made any. Cradle foot we are making. We do not use the reverse motion in making cradle foot. We used the stud wheel. An altogether different attachment. We did not use the Pointex attachment any way for that, we used the stud wheel.

As to those old original attachments that I referred to, the ratchet attachment. We had two of those on a Ludwig machine. Two of them were part of the machine itself. They came from Germany on the machine. I have heard of a Landenberger attachment. I do not remember ever seeing one of the Landenberger attachments on the machine. That was sort of a drum device for making Pointex heels.

Mr. Howson: I think that is all.

Redirect examination.

By Mr. Darby:

The Witness: I referred to some Schubert and Salzer machines. As to the exact date when they were acquired, I will say that there were some acquired I guess three or four years ago. We got them at different times.

I have charge of the supervision of the records of the Kayser Company insofar as our work is concerned. I have extracted the employment cards of Adolph Hecker and Peter Hockin. I have the original cards here with me. I recognize this photograph as a photograph of our original records of their employment.

Mr. Darby: I offer these photographs in evidence.

(Received in evidence and marked Exhibit D-L.)

[fol. 975] The first two Lieberknecht machines we acquired came with the attachments and we thereafter put the attachments on fifteen other machines. We made these other attachments in our shop. We used only the original attachments as patterns for making those attachments. We have got original records which enable us to state when that work was done. There is a record ordering castings to make up these new attachments. That work was started

October 7, 1921. They were completed some time in January, 1922.

Mr. Darby: I offer in evidence photographic copies of the record of October 7, 1921, referred to by the witness. There are two of them there.

(Received in evidence and marked Exhibit D-M.)

PERCY HOCKIN, called and sworn on behalf of the defendant, testified as follows:

Direct examination.

By Mr. Darby:

I live in Brooklyn. I am employed by Julius Kayser & Company. I first went with them in 1915. I went there first as a machinist. As to whether I was familiar with the machines in use at that time I will say that when I first went there I went in the weaving department, and that is a somewhat different type of machine. That is a machine for making gloves and underwear fabrics.

I was familiar with certain parts of the machine for making hosiery, but I went as a fixer in 1925. I was first familiar with the Lieberknecht machine, with the slipper heel attachment in 1921. When I say the slipper heel attachment I mean that was the Kayser name. It was a product of the Onyx. When I say a slipper heel I mean a pointed heel.

[fol. 976] When I came in contact, working with the machines themselves I had seen the machines in operation before that time, from the time I went into their employ.

I have been shown Exhibit J and I recognize the machine there shown and the attachment there shown as the attachment I saw in operation on the Lieberknecht machine. As to whether those machines were used continuously with this attachment in the manufacture of pointed heel stockings throughout my life there I will state that I don't say all the time they were there, but the time I knew they were working on it was around the beginning of 1922, that is when I came in contact with it, the end of 1921, we got an order to make fifteen attachments same as what were on the original two machines and we took down one attachment

and got the dimensions and we used the castings on the original attachment for the patterns for the new ones and we made fifteen. That completed seve[illegible]en in all.

As far as I know all those machines went into operation. Of course I was in the machine shop at tha[illegible] time.

Mr. Darby: That is all.
Mr. Howson: No questions.

(No cross-examination.)

ADOLPH HECKER, called on behalf of the defendant, being duly sworn, testified as follows:

Direct examination.

By Mr. Darby:

I live at Glendale, Long Island. At the present I am out of work. I did work for Kayser Company beginning in 1919 as a machinist.

[fol. 977] I had knowledge at the time I entered the employ of the Kayser Company of the Lieberknecht machine. Two of those Lieberknecht machines were provided with an attachment for making pointed heels.

I stayed with the Kayser Company nearly five years. I did not have anything to do with making duplications of those attachments for their machines but I worked those two attachments in. They were out of use when I got there. I mean the two attachments on the original machine. They were not used at that time for making Pointex, they were idle. That was in 1920 I broke them in, I had other work to do before. It was the summer of 1920 I worked them in, that is when the demand for the Pointex heel came. When the demand for the Pointex heel came I worked those machines in.

I didn't have anything to do with the fifteen additional machines. I was there when those fifteen additional attachments were built. I was there when those attachments were put in operation. The original two machines were continuing working throughout that time. All seventeen machines were used in the normal production of pointed heel stockings by the Kayser Company.

Mr. Darby: That is all.
Mr. Howson: No questions.

(No cross-examination.)

Mr. Darby: I offer in evidence the stocking which was marked for identification Defendant's Exhibit C and which it is agreed was made by the Kayser Company, at least as early as 1916. It will be marked Defendant's Exhibit E.

(Stocking received in evidence and marked Defendant's Exhibit E.)

[fol. 978] And for the purpose of enabling the Court and counsel to follow again we will now take up what we term the Nusbaum defense.

JACOB BOCH, called on behalf of the defendant, being duly sworn, testified as follows:

Direct examination.

By Mr. Darby:

My age is forty-seven. I reside at Glendale, Long Island. I am employed by Nusbaum Knitting Company, Incorporated. That is the successor to D. Nusbaum & Company. At the present time I am foreman. I have worked for Nusbaum or its predecessors since 1907. When I first came with Nusbaum my work was as an apprentice. I have worked continuously with Nusbaum since 1907, with the exception of one year. That was in the early stages.

The Nusbaum Company was in the business of making of bathing suits and underwear. We used knitting machines for that purpose.

They were the Schubert and Salzer type of knitting machines. Full fashioned Schubert and Salzer machine. Those machines were manufactured in Germany. They were flat type of knitting machines. I became familiar with those machines when I first came with the company. The full fashioning was effected by the spindle on both ends. These were threaded spindles at both ends. As to whether the threads were in the same direction, I will say one went one way and the other the opposite way, right and left, what we call right and left spindle. There was one at each

end of the machine. A nut was mounted on the spindle to move when the spindle rotated.

The spindles were rotated from a pattern chain, which would hit into the pawl with a ratchet that would make the machine go either, both ways, either right or left, in or out. [fol. 979] In other words, the nuts would travel either towards each other or away from each other, on both ends the same. The spindle was rotated either direction from the cam shaft. There was more than one pawl. There were two pawls. One pawl actuated the spindle in one direction and one pawl actuated the spindle in the opposite direction.

In knitting garments, that is full fashioned garments such as a bathing suit, it was necessary during the operation of the machine in forming the full fashioned garment to have the spindle rotate in both directions.

I have made some alterations on that machine in 1916. I came to make these alterations because of the demand of the purchasing public. In 1916 we wanted to make a plated garment. I mean by a plated garment, laying another course of thread over the main course—we did that with bathing suits, we did not use the same material for both the plate and the ground. We used rayon on the face side and worsted or mercerized cotton on the ground side. The Nusbaum Company began the manufacturing of that type of garment at that time.

I can identify this (indicating) garment shown me. I made that garment myself in 1916. This is an illustration of the plated full fashioned bathing suit. The rayon is on the outside. Mercerized cotton is on the inside. Nusbaum made and sold, to my knowledge, bathing suits of this type at that time.

Mr. Darby: I offer the bathing suit identified by the witness in evidence.

(Received in evidence and marked Defendant's Exhibit M.)

The machine, as I became familiar with it, was not adapted to make plated garments.

In making the single thread garment, there was only one yarn carrier or thread carrier used. In making the plated [fol. 980] garment, there were two thread carriers used. There were more than one thread carrier which came with the machine. Two came with the machine. In making the

single thread garment we only used one. When we had alternate striped bathing suits we used two, which came with the machine—one thread carrier carrying one color and the other thread carrier carrying the other color.

When we came to plating in solid colors, we used both thread carriers. As to whether we had to modify the machine in order to enable us to plate, I will say that we could use the original machine as it came, for the plating. In order to apply the control friction box, we had to have a one-half inch lead across the machine. In order to apply a plating thread it is necessary for one carrier to have a one-half inch lead over the sinkers. If you did not provide that you could not call it plating. The threads would twist in.

The Court: You mean a part of the mercerized would be on one side and part of the rayon on the other side?

The Witness: Yes. It would be all twisted up.

I put on this additional friction box. Mr. Drawert helped me. He worked in the machine shop. He worked under my direction, and we put them on. That equipment then enabled us to plate anywhere in the fabric between the margins of the fabric.

The plating would have to be parallel to the shape at the margin if you were making a full fashioned garment.

Thereafter we had occasion to want to put irregular-shaped designs in the fabric by plating. That was in 1917. We used stationary stops for that purpose. We used the same equipment that came with the machine, only we applied the stationary stops on both sides—meaning the both [fol. 981] nuts and spindles. To make the design between the edges of the fabric, we used the fashioning equipment that came with the machine without changing any fashioning equipment at all, but we made this operation take place between the side edges of the fabric.

When we used the fashioning equipment for the purpose of making designs in any part in the center of the fabric, we had a straight selvage edge on the fabric. We limited the throw of the carrier by stationary stops. Those stationary stops did not come on the machine. I put on the stationary stops.

The Court: What were they put on? The carrier?

The Witness: No, sir. On the casting of the machine. Those stops were cast. They required wooden patterns; wooden models. I made the patterns. I have got those patterns here. These are the patterns that I made (indicating) both right and left. That is one pattern for a stop at the right end of the machine and one at the left end of the machine.

Mr. Darby: I offer the patterns in evidence.

(Received in evidence and marked Defendant's Exhibit N.)

Those patterns were made in 1917. The castings were made from the patterns in 1917. In order to put those stops on the machine work had to be done on the machine. We had to drill some holes to hold them in place. Mr. Drawett did the drilling of that. He was working under my supervision. He actually drilled those holes. The fixed stops were then positioned in those holes. I applied them. They were secured to the machine by means of those holes.

The drawing shown me correctly illustrates the mecha- [fol. 982] nism consisting of the full fashion equipment that came with the machine plus the fixed stops that I put on and the mechanism for moving the fashioning machine automatically in either direction.

I will now point out the reversely threaded spindles located at the opposite ends of the machine. They are at the left end of the machine, it is the spindle marked A at the right end of the machine, it is reversely-threaded spindle, marked B. The nut that moved on the left spindle is marked C and the one on the right spindle is marked D.

The fixed stop that was put on the machine at the left end of the machine, we will mark E and the stop at the right end we will mark F.

The Court: And they are shown in dashed lines on the right side and left side too?

Mr. Darby: Yes, sir.

The Court: Is part of the stop this part in the dashed lines that is above the spindle on each side?

The Witness: Yes, sir.

The Court: That is included in the stop?

The Witness: Yes.

The ground or plating carrier played against the fixed stop. We will mark that G. When the machine would knit

the fabric with the fixed stops the selvaged edge would be in a straight line. That was due to the fact that the stops were fixed.

We provided means in those stationary stops which would permit you to narrow the entire fabric, that is in case you wanted to make the width of the fabric say an inch narrower. As to this here nut, we could adjust that in or out. The nuts that I marked H.

The Court: Is that the nut?

[fol. 983] The Witness: It is connected with that. You don't want to call that a nut.

Q. 111. What do you call it? Tell me what it is?

A. This is a stop.

The Court: Adjustable screw.

Q. 112. Adjustable screw?

A. Yes.

The Court: That is what it looks like.

The Witness: Adjustable screw. One of those is provided at each end.

The Court: That, of course, had to be adjusted manually, by hand?

The Witness: Yes, you want a different size, not to waste too much material. If you adjusted it manually the selvage edge of the fabric would be the same throughout the garment.

We made a plated type design of garment with the fixed stop. Bathing suits. It was a cut and sewn garment, as distinguished from the full fashioned garment.

We would effect the plating of any place within the marginal edges of the fabric, the plating design, that is plating anywhere within the marginal edges of the fabric—with the nut C and the nut D. The carrier which was stopped by the nuts C and D was the one that carried the rayon or the face. That is it, the ground part. I will mark that J. That one would go in between the nuts.

I will indicate on the drawing the pattern chain that was employed there. There are two views of it, here is one and here is the other (indicating). The pattern chain we will mark K. And that pattern chain would through the actuating mechanism while the machine was in operation move

[fol. 984] the nuts C and D towards and away from each other. For controlling the design of fabric that was made anywhere between the selvage edges of the fabric.

Mr. Darby: I offer the drawing in evidence.

(Drawing received in evidence and marked Defendant's Exhibit O.)

The Witness: I recognized these photographs that are handed to me. They are photographs of the machine that I have just been describing. I was present when they were taken. They were taken quite recently. The fixed stops have been removed from the machine to show the holes that were drilled. I will point out on the second photograph holes that were drilled for the fixed stops.

Mr. Darby: On the second photograph. We will mark those holes A.

(I offer the photographs in evidence.)

(Photographs received in evidence and marked Defendant's Exhibit P.)

The Witness: I have samples of the work done with the machine as I changed it so as to enable me to use the original fashion, margin selvage fashioning attachment to make design between the selvage edges. I made them myself. That is plated type of work. In the trade they call sample pieces like this, swatches. These swatches were made in 1916. It will be noticed that the margin of the plated work runs parallel to the selvage edge. Those were made before we had put on the fixed stops. The only change that had been made in the machine at that time was the addition of the friction boxes that I referred to.

Mr. Darby: I offer the swatches in evidence.

(Swatches received in evidence and marked Defendant's Exhibit Q.)

[fol. 985] The Witness: Another piece of cloth which is now handed to me I made myself in 1919. That was not made in response to any order to make particular material I was just working the machine to illustrate what it would do. This has been in the possession of my company ever since I made it. These various shapes and designs were

made with the machine, made on this fabric with the nut as it came to the machine. That is, they were made with the machine as modified in accordance with my testimony. With the fixed stops at the end and using the original full fashioning equipment for making the intermediate designs.

Mr. Darby: I offer this piece of fabric in evidence.

(Piece of fabric received in evidence and marked Defendant's Exhibit R.)

The Witness: I have other random samples of fabrics that were made and sold employing the designs. I have got other samples of fabrics that were made and went into commercial bathing suits. These are samples of the various designs that went into commercial use (indicating). These fabrics were made on this same machine.

Mr. Darby: I offer the group of fabrics consisting of three separate pieces.

(Fabrics received in evidence and marked Defendant's Exhibit S.)

The Witness: Representatives of the Textile Company called to see me recently, in connection with these machines. They called more than once. I showed them the machine, and made available to them all the information at our command. I showed them samples. I offered to work the machine for them. I told them how long we had it. I gave them any information they desired.

Mr. Darby: You may examine, Mr. Howson.

[fol. 986] Cross-examination.

By Mr. Howson:

The Witness: I said that the regular business of the Nusbaum Company is the manufacture of bathing suits and underwear. Sweaters also, but in our department is only bathing suits and underwear. We had five Schubert and Salzer machines in use back in 1916 and 1917, at the time I was testifying about. We put these fixed stops on two machines. They were the same machines. On three of the machines I said we did the plating work and on two of the machines we put fixed stops. Those two machines were two of the three on which we did the plating work.

The other two machines did plain work—our regular work. Our regular work is just plain work. It is full fashioned work. In doing that work, we use for fashioning, these spindles or stops I have referred to.

I said we experienced a demand for the plating work as early as 1916, in fact, we made many orders in reference to them.

X Q. 189. And you experienced a demand for the design work which you made by the use of the fixed stops as early as 1917?

A. I made that swatch in 1917.

X Q. 180. I understood you to say in answer to Mr. Darby, that the reason you put those nuts on was because you had a demand for designs of that type which could be made?

A. Nuts? Have you reference to the nuts on the spindles?

X Q. 181. No, the fixed stops I am talking about, that you put on to utilize the machine in the making — these plated designs. How did you come to do that?

A. When did I come to do that?

X Q. 182. How—what led you to do that?

A. To make a design in the center of the garment. We had a demand for that kind of garment.

[fol. 987] At that time, that is, the trade demanded it in 1917.

We do not manufacture hosiery. These machines are not used by us in the manufacture of hosiery. First, as to the plating designs. In "plating" I mean the regular plating as distinguished from the plating designs which were made a little later, such as is illustrated in Exhibit M. We have much of this character of work, plated work. We get orders now and then. The last that I can remember is a few years back, but I cannot establish a date on it. I would say it was about two years back or so. I do not mean that we have not made any of the full plating work recently. We just get an order now and then for a few.

This garment, Exhibit N, represents a garment that was actually sold. Garments similar to that were sold. That was a sample garment. This is a full fashioned garment. In fashioning the garment we used the nuts on the threaded spindles which are a part of the original machine as it came, and that is the regular fashioning means built in as an operating part of the machine. The carrier bars that carry

the thread guides for laying the threads, travel the full width of the garment, both of them. The travel is controlled at the two ends by means which are controlled by these spindles and these nuts on the threaded spindles. There is one threaded spindle at one end of the machine and one at the other end of the machine and they are connected by a long narrow bar that runs clear across the machine. This Exhibit R does not represent a garment that was sold. That was the first stage of experiment. I dated that in 1919. I was experimenting with it in 1919, you can see there is nothing complete on it. My experiments continued a few months before I manufactured. I can't tell you when I last used those fixed stops for fixing the machine so that you could make the plated design. I could not tell you exactly when it was. It was a few years [fol. 988] ago. It has been some years ago. It was not as long ago as 1919. I think we used them within a year of 1919. It was between '19 and '20 we started to manufacture.

The Court: The question is, how long have you used, actually in practice, these actual stops you put on.

Mr. Howson: Yes.

The Witness: When the occasion arrived.

The Court: When did you quit using them entirely? You have quit using them now entirely, have you not?

The Witness: Yes.

The Court: Mr. Howson wants to know if you can recall approximately what time you quit using them.

The Witness: You see, they were used in reference to garments as the orders arrived, and of course a few years back, when we would get an order like that occasionally, we would apply them again.

X Q. 212. The best you can tell us is that it has been some years since you have used that; is that right?

A. Yes.

X Q. 213. These samples making up Exhibit S, what do they represent? I mean they are just presented here as samples. Where did these samples come from?

A. From the machine that I adjusted.

X Q. 214. When?

A. In 1917 I started to make them. I mean I made these particular things in 1917. These are some of my experiments. Some of them represent garments that were sold. in

later years. This one (indicating). In fact, all of them do. [fol. 989] We have pictures of these. These particular samples I think are some of my experimental work back in 1917.

Now, the real function and intended purpose of these nuts or stops on the threaded spindles, which are controlled by the machine, is to enable us to make on that machine a fashioned garment.

And in order to make the garment with these plated designs, we then had to use the fashioning stop for making the designs. It is correct that we cannot operate that machine in making a full fashioned garment, not in making designs.

X Q. 224. In other words, when you add the fixed stop to take care of the carrier bars at the end, at the selvage, and use the means which were really the fashioning means of the machine to control the carrier that makes the design, then you are not making a full fashioned garment?

A. No, sir. You are making a cut and sewed garment.

X Q. 225. Supposing you want to make a garment on that machine which is shaped. You would have to knit it with a straight selvage and then cut it to shape?

A. Those swatches you have there, we can run it within the width you desire from the outside selvage and parallel with the fashion and make a full fashioned garment at the same time.

X Q. 226. You are not quite answering my question. I want to know when you want to make a garment which is shaped, fashioned, and you are making the plated designs and using the fashioning stops on the machine for making the design, you use your fixed stops to control the garment at the selvage?

A. Yes. If we want to shape a garment with a plated design it is possible to knit them straight and then cut them to [fol. 990] shape. In fact, that is the only way we could shape it.

X Q. 231. That is not very desirable, is it? The cut and sewed garment?

A. Of course, it costs less than full fashioned garments.

X Q. 232. And you get less for it, don't you?

A. Yes. I mentioned in connection with this drawing, Defendant's Exhibit O, that we had certain adjusting screws marked H on the fixed stops. Those are adjustable by hand, and only to vary the fixed width of the garment that we are going to knit. I cannot say how many years ago it is we stopped using those fixed stops.

Redirect examination.

By Mr. Darby:

The Witness: I said in cross-examination that the garment, at least the sample Exhibit R, was not a plated design. That is a knit-in design. The samples of Defendant's Exhibit G, they show a plated design.

(Mr. Darby hands exhibit just referred to to the Court.) Those are types of plating.

The Court: Yes, I see.

The Witness: Both types of work were done on the same machine.

I am familiar with the advertisements of my company.

I am familiar with the work that was put out to fill the demand created by the advertisements. My attention is called to a book and I can state that it is an advertisement book of D. Nusbaum and Company's merchandise. I notice that the last advertisement runs up to April, 1929, as appears in this book. I can identify the garment advertised [fol. 991] there as one made on our machine. Both of these (indicating). That is on the page dated April 10, 1929, page 44 in blue.

My attention is called to the advertising appearing on page 35 under date of September, 1928. I recognize the garment there shown. That was made on our machine. I made that myself. That was not a fashioned garment. It was plated. That was made on the machine that I have described in the court room today.

My attention is called to the advertising appearing on page 27, advertis-ment in the knitted sportswear Retailer of June, 1928. I recognize that garment. That was made by me on that machine. That is not a fashioned garment.

My attention is called to the one on page 23 under date of April, 1928. That garment with its design was made by me. That was not a full fashioned garment. It was made on this machine I have described.

My attention is called to the advertisement appearing in the Daily News article of Wednesday, March 21, 1928, appearing on page 21 of this book, and to the bathing suit shown on the right-hand side of the page, and the various bathing suits shown on that page. Two of them are of a design pattern. I made those bathing suits—before that

day. Yes, we made some before that day also. They were made on this same machine that I have described in the court room.

The same is true of the design bathing suit shown on page 20 of the book, being an advertisement from Sweater News in Knitted Outwear, March, 1928. That was made by me on this machine. With reference to the particular design, I can state as to whether or not that was an adaptation of the design which is included in the specimens Defendant's Exhibit S. This is an instance where we had adapted one of our earlier designs.

[fol. 992] My attention is called to the advertisement on page 19. That is a plated design made on the machine I have described here.

The Witness: My answers are the same with respect to the advertisements appearing on pages 19, 16, 15, 13, 12, 9 of this book.

Mr. Darby: I offer in evidence pages 9, 12, 13, 15, 16, 19, 20, 21, 23, 27, 35 and 44 of this book of advertisements, with the understanding that I may substitute photographic copies of them rather than the book.

(Book received in evidence and marked Defendant's Exhibit T.)

The Witness: I notice that in the Defendant's Exhibit O in the drawing there are three thread carrier rods. The machine did not come with three carrier rods. It came with two. I supplied the third carrier rod. In answering one of the questions asked me by Mr. Howson I understood him to ask me whether or not the spindles A and B were connected together across the machine. They were not connected together.

Mr. Darby: That is all.

The Court: The witness did say that. I don't know whether he understood Mr. Howson's question.

Recross-examination.

By Mr. Howson:

R. X Q. 276. Well, evidently I mislead you?

A: Yes.

R. X Q. 277. In asking that question, and I should perhaps have put it this way, that in order to control the two

separate spindles at either end of the machine there must be a control bar or bars which I marked on Exhibit O with the letter X which extend the full length of the machine?

[fol. 993] A. Yes, sir; that controls the spindles.

R. X Q. 278. Now, in this scrap book of advertisements which has been offered as Exhibit T it is my understanding that all of the garments to which Mr. Darby called your attention at different pages are they plating designs or plain selvage garments and not fashioned garments?

A. All of them. You would have to show me—I wouldn't answer that question, that is, in the blind.

R. X Q. 279. All right. Pick out any garment there.

A. Full fashioned garment?

R. X Q. 280. Among the pages which Mr. Darby called to your attention which are full fashioned garments and have your plating designs put in by these fashioning stops. Do you want to know the pages you referred to?

A. A garment like this on page 21 is a full fashioned garment and also——

—. ——.

A. This here also on page 44, only the one. I think that is about all.

(After a short recess.)

Mr. Howson: That is all.

Redirect examination.

By Mr. Darby:

R. D. Q. 282. Let me ask you just one more question, please. In the questions that Mr. Howson asked you pertaining to the use of the identical stops that you put on and which are shown as fixed stops H in the drawing Defendant's Exhibit O, did you subsequently make additional stops of different constructions?

A. This is the kind we are using now. But we are still using machines with fixed stops.

But it is these particular stops H that we disconnected several years ago, or a number of years ago. They are only used for plating.

[fol. 994] By permission of the Court I wish to modify——

On page 44, in reference to what you asked me——

"Is it a full fashioned garment?"

It is full fashioned up until the armhole, and then there is a special armhole.

Mr. Darby: That is all.

FRED DRAWERT, called and sworn as a witness on behalf of the defendant, testified as follows:

Direct examination.

By Mr. Darby:

The Witness: My age is thirty-two years. I live at Jamaica, L. I. I am employed by Nusbaum Knitters, Inc. I have worked for Nusbaum, or its predecessor since 1915. First I started as an errand boy. Then I became a machinist's helper. While I was working as a machinist's helper, I did some work on a knitting machine in altering its construction. It was a Schubert and Salzer full fashioned machine. The machine was used for knitting full fashioned bathing suits. As to the work I did on the machine, I will state that I put the stationary stops on the outside. I bored holes in the machine and threaded them and bolted the stationary stops on.

I recognize the photographs shown in Defendant's Exhibit P. They show where I drilled the holes. This is a photograph of the machine I drilled the holes on. Referring to the second photograph, I can identify the holes I drilled. They are right there, marked A. I did that work right before this country went into war. I fix the time as follows: At that time there were mostly Englishmen working in that department, and at that time with every package [fol. 995] of cigarettes you got a small flag, about that size (indicating). About four inches. And I had a German flag hanging up in the machinist department where I was working. I wasn't German, but I was of German descent. I was born in this country. And when I was drilling them parts on the machine there the English fellows and I used to be arguing about the war. And when I was drilling them parts the English fellows would always say, "Here is the

bloody Dutchman now." I recall it was while I was drilling those holes that that happened. It was while I was working on that machine. We entered the war, and then the flag came down. There was no more "Dutchman."

I recognize those pieces of wood marked Defendant's Exhibit N. They are the wooden models for the outside stops. I know who made them; Mr. Boch made them. I saw him making them. Castings were made of these stops. I did not have anything to do with them. I bolted them on the Schubert and Salzer machine. I saw the machine operate after that. I recognize this particular piece of fabric, Defendant's Exhibit R. But that has no connection with those stops. I recognize this fabric. I saw it made. Mr. Boch was making it. When I saw him doing this I was working on a machine at that time, working as a knitter. I was just starting on plain full fashioned work. That was in 1919. Mr. Boch was on the machine opposite me, in the next aisle.

Mr. Darby: That is all.

Cross-examination.

By Mr. Howson:

The Witness: The argument continued with the English fellows all the while. I did other work on those machines, besides boring those holes.

Mr. Howson: That is all.

[fol. 996] FERDINAND NUSBAUM, called on behalf of the defendant, being duly sworn, testified as follows:

Direct examination.

By Mr. Darby:

My age is forty. I reside at Jamaica, Long Island. I am head of the Nusbaum Company. I started work there in 1906 in a managerial capacity. The company was originally formed by my father in 1906. I am familiar with the machinery and equipment employed in my factory. We make bathing suits, underwear, tights and garments of that nature.

I am familiar with the Schubert and Salzer machines concerning which Mr. Boch has testified in this case. I am

familiar with the modifications to the machines that he made. I have my original records as to when Mr. Boch and Mr. Drawert entered my employ. I will read from those original records when they entered our employ respectively; Mr. Boch, March 2, 1907; Mr. Drawert, May 7, 1915. Mr. Boch was made foreman January, 1916.

Mr. Drawert became a knitter, as distinguished from an apprentice, in 1919.

As an errand boy, we paid him four dollars a week salary; as an apprentice——

The Court: I think he said he was a machinist's helper, wasn't he, after he was an errand boy?

Mr. Darby: Machinist's helper, yes, that is what I meant.

The Witness: First, let me say this, there is nothing on the card here to show definitely that he changed his work from one kind to another excepting the increase in wages. That shows that in 1917 he was raised to eight dollars a week. At that time he was spending more time as a machinist's helper. As a knitter he started with $15.

[fol. 997] I am familiar with this varied design sample, Defendant's Exhibit R. I saw that fabric being made. It was made in 1919. This sample since it was made has been in the department in the care of Mr. Boch.

I am familiar with the garment, Defendant's Exhibit M, bathing suit. That is a type of garment that we manufactured and sold. I have original records showing sales of a garment of that character. Here is one of 1917 as an example which tells how many garments were sold, to whom and the date. It shows a sale of about two dozen to Marshall Field, order taken October 31, 1917, shipment made February 13, 1918. The garment differed from the one there in being a two-color garment instead of a one-color garment. It was a plated garment. There were stripes running through it, either end stripe or similar stripes. But it was plated.

Mr. Darby: I offer in evidence the original record. I would like to make a similar request that we substitute a photographic copy of it.

(Received in evidence and marked Defendant's Exhibit U.)

I have additional records of the same type of sales prior to 1920.

This book, Defendant's Exhibit T, is a record of our advertisements. Those records are in my charge. I can say as to the accuracy of the records appearing on the various dates as to the date of the advertisement attached to each page that they are accurate. In most instances the advertisements are dated, either on the advertisement itself or in ink on the advertisement. I extracted this or had this book extracted from the files of our company and made available in this case.

I was present at my factory when representatives of the Textile Machine Works, the plaintiff in this case, came to [fol. 998] our factory to inspect our equipment. They asked my permission to be shown the equipment. I gave them that permission. I told Mr. Boch to tell them anything they asked.

Cross-examination.

By Mr. Howson:

The Witness: There was not any particular reason why I shouldn't do that.

As to whether there is anything on Defendant's Exhibit U which identifies the particular garment that I refer to, I will say there is on the confirmation from the customer there is a description fiber and mercerized. That does mean that it was a full plated garment of the order of plating exemplified in Exhibit M. That is the only way that we use those yarns, in combination. It was plated all the way across and on this it also says full fashioned, showing that it could not have had the plated design. I would not say showing that it could not, but that particular style, we sold so many of that particular style that I know exactly what the garments were, and they were plated all over.

X Q. 44. I think Mr. Darby referred you to an invoice of 1920.

Mr. Howson: Did you?

Mr. Darby: No, I said prior to 1920. That is the only invoice he testified about. He has got plenty more there if you want them.

X Q. 45. May I look at those? (Papers handed to counsel.) Well, these other invoices that you said you had prior to 1920, do they relate to the same type of garment as this one, Exhibit U?

A. Those invoices do (indicating). I have an invoice of one garment made similar to that, one at the end, whatever it is.

[fol. 999] X Q. 46. Similar to Exhibit Q. What is the date of that?

A. That is May, 1918.

X Q. 47. Were you asked to look for any invoice that had to do with a garment having plated designs of the order illustrated in Defendant's Exhibit S?

A. I don't remember that I was asked for invoice for those things. I was asked for invoices as early as possible, that is invoices of plated garments as early as possible, and I brought some of the earliest invoices I could find.

X Q. 48. I see. May I see that card that you had in telling how much these men were paid? (Card handed to counsel.) Is this in your handwriting?

A. No, sir.

X Q. 49. Do you have anything to do with *the* keeping these records personally?

A. No.

Redirect examination.

By Mr. Darby:

The Witness: I was asked on cross-examination about the swatches, Defendant's Exhibit Q. I know when those swatches were made. They were made the end of 1916 or beginning of 1917.

Nusbaum & Company purchased the Schubert and Salzer machines with other equipment at the time of its organization in 1906. To my knowledge, that machine has been in our possession since that time.

This book that is handed to me is also a record of our advertisements beginning in June, 1923.

My attention is called to an advertisement on page 22 of this book, likewise on page 23 and page 24 and shown perhaps best on page 25, referring particularly to the leg portion of the bathing suit there shown. I know what machine that bathing suit was made on. That was made on one of [fol. 1000] the Schubert and Salzer machines. It was on a 21-gauge machine. That is one of the machines that was modified by Mr. Boch. That is, the machine that made that piece of work was modified. I am familiar with the modification that was made by Mr. Boch. The machine was the one with the fixed stops that produced that design in the

leg of the bathing suit shown on that page. I am going to say to the best of my knowledge, it is because I know that we have fixed stops on several machines but this type, if it is this type of work that you referred to, it can be made with fixed stops and would be made that way, in our factory.

The advertisements in this book were likewise kept by me and produced from our original files of my records.

At subsequent pages of the book I notice, for example, at page 67, under date of May 1, 1925, there is what is termed "Pearl Shell" bathing suits. That type of bathing suit was plated all the way through exactly the same principle as that sample, Defendant's Exhibit M.

Mr. Darby: I offer in evidence pages 22, 23, 24, 25, 26 and page 67 of the book identified by the witness and I call the Court's attention to the type and the date. What we are referring to is the stripe down the middle of the leg portion. This shows a larger view on page 25, and shows it on the pants alone on page 26. These were all in 1924. And the other page 67, this is the "Pearl Shell" completely plated, June, 1925 (indicating).

The Court: The book had better be marked.

Mr. Howson: I should perhaps object to the offer insofar as the documents may be intended for use as evidence of the truth or accuracy of any statements of fact contained [fol. 1001] therein on the ground that they are not competent evidence of such fact.

The Court: I think that is so, they are purely illustrations to illustrate the testimony of the witness. They are admitted for that purpose only.

Mr. Darby: I would hate to have it stay on the record just that way. The purpose of these advertisements is to show that on those dates a good many of them are photographs, at least by those dates the garments there shown had been manufactured and were offered for sale.

The Court: Well, the witness has testified to that. That is illustrating the witness's testimony, to that extent it is evidence because he says that that was the garment made, sold and made on these machines, as I understand it.

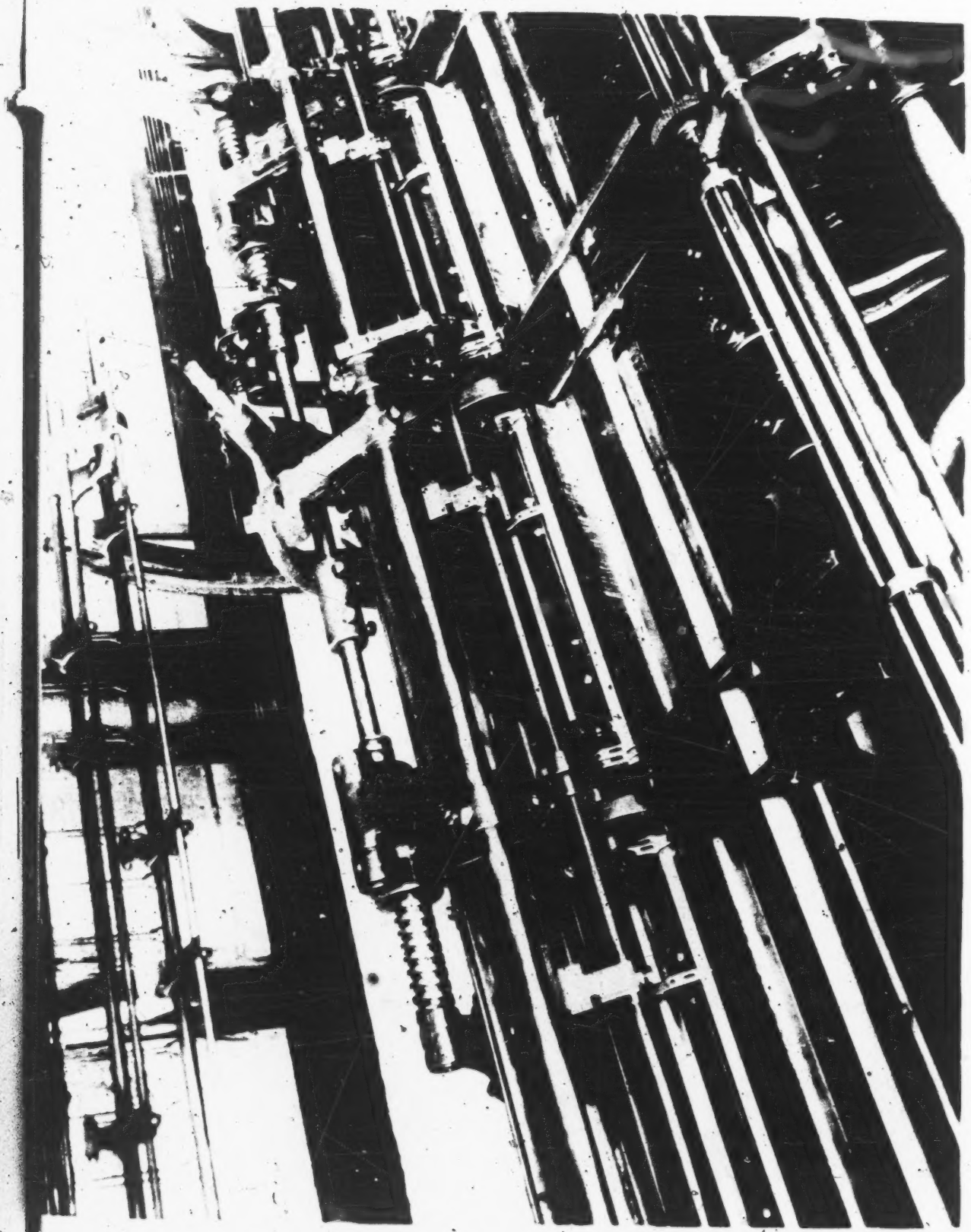
Mr. Darby: Yes.

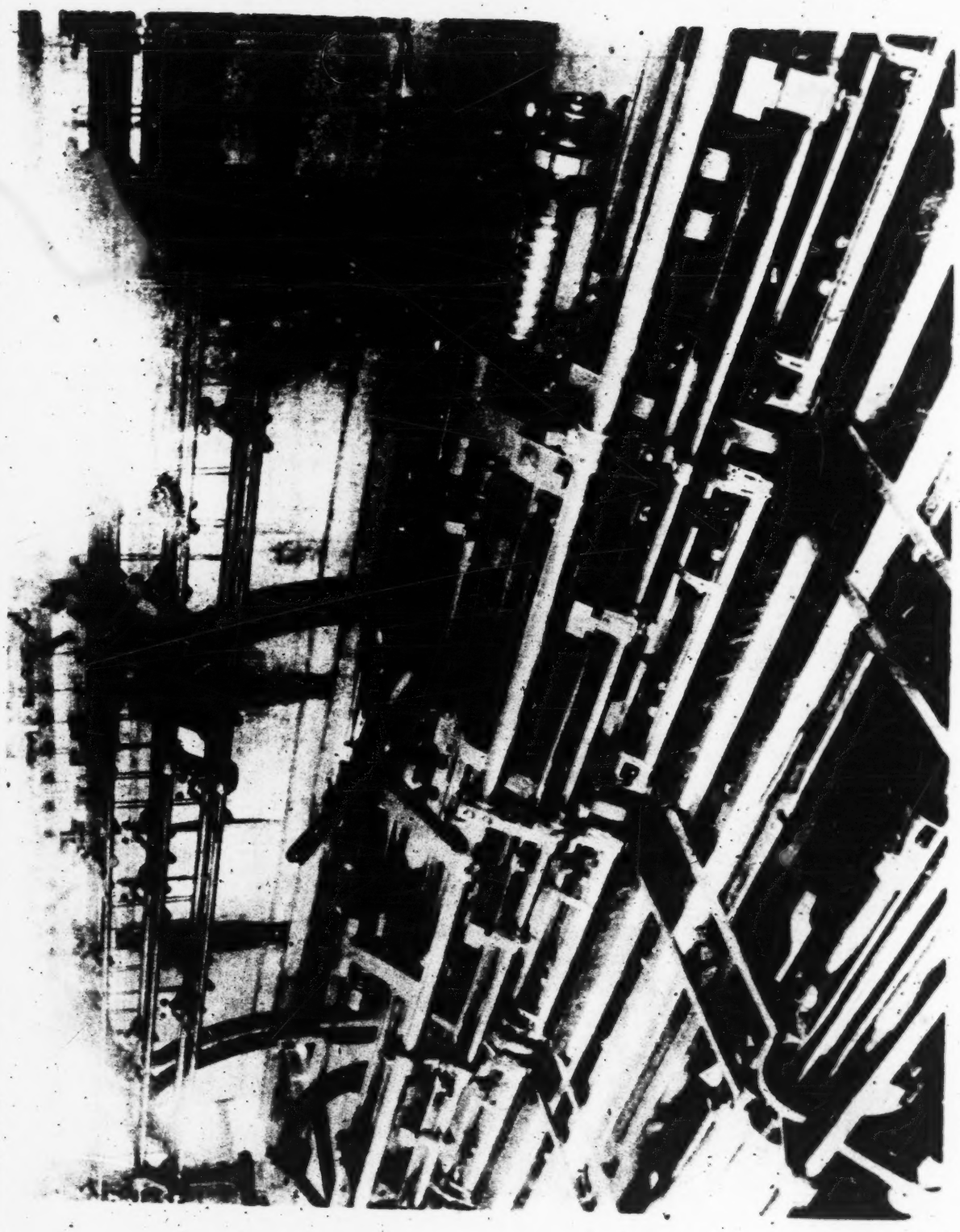
(Book received in evidence and marked Defendant's Exhibit V.)

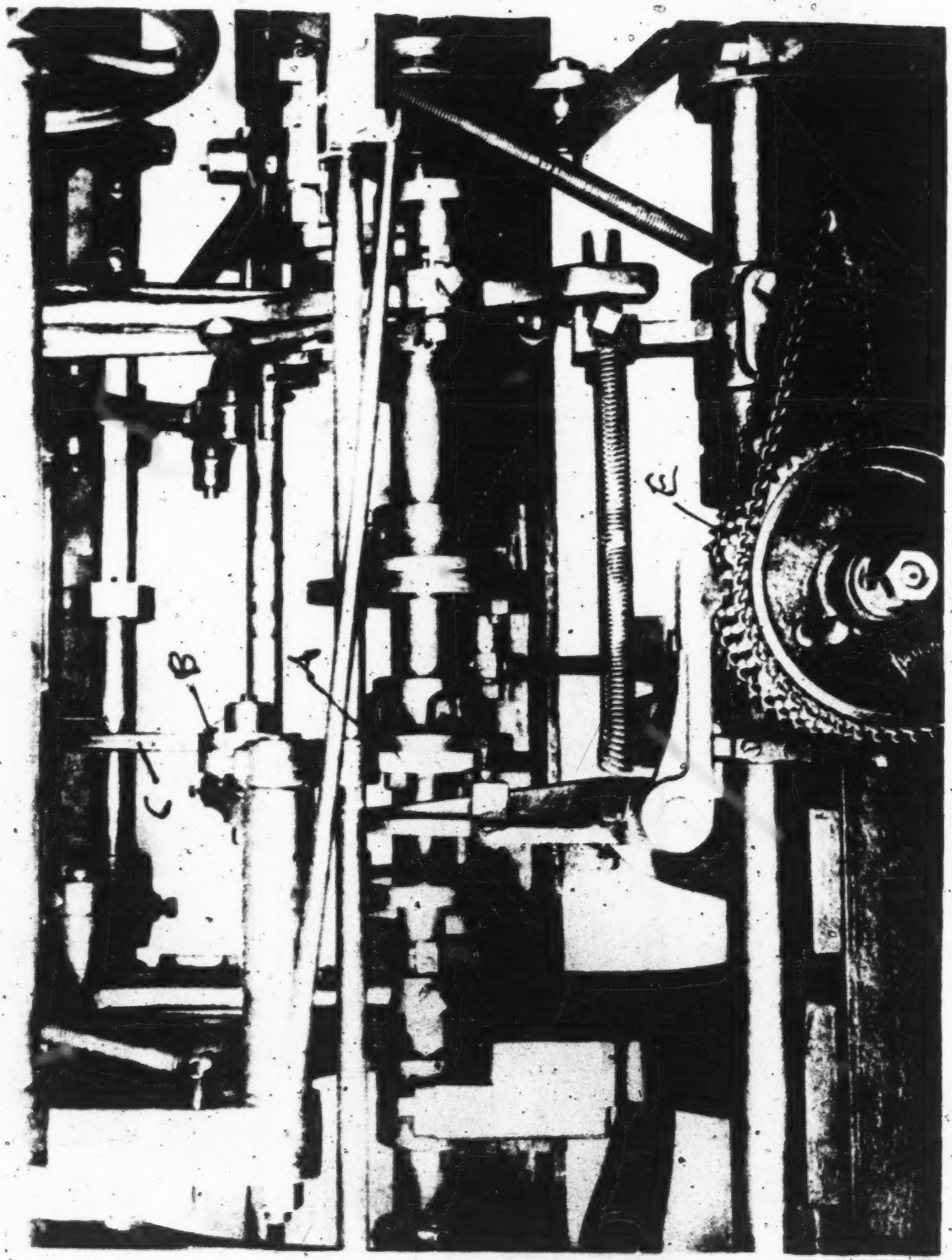
Mr. Howson: No questions.

The Court: That is all.

[fols. 1002-1006] DEFENDANT'S EXHIBIT Q-1



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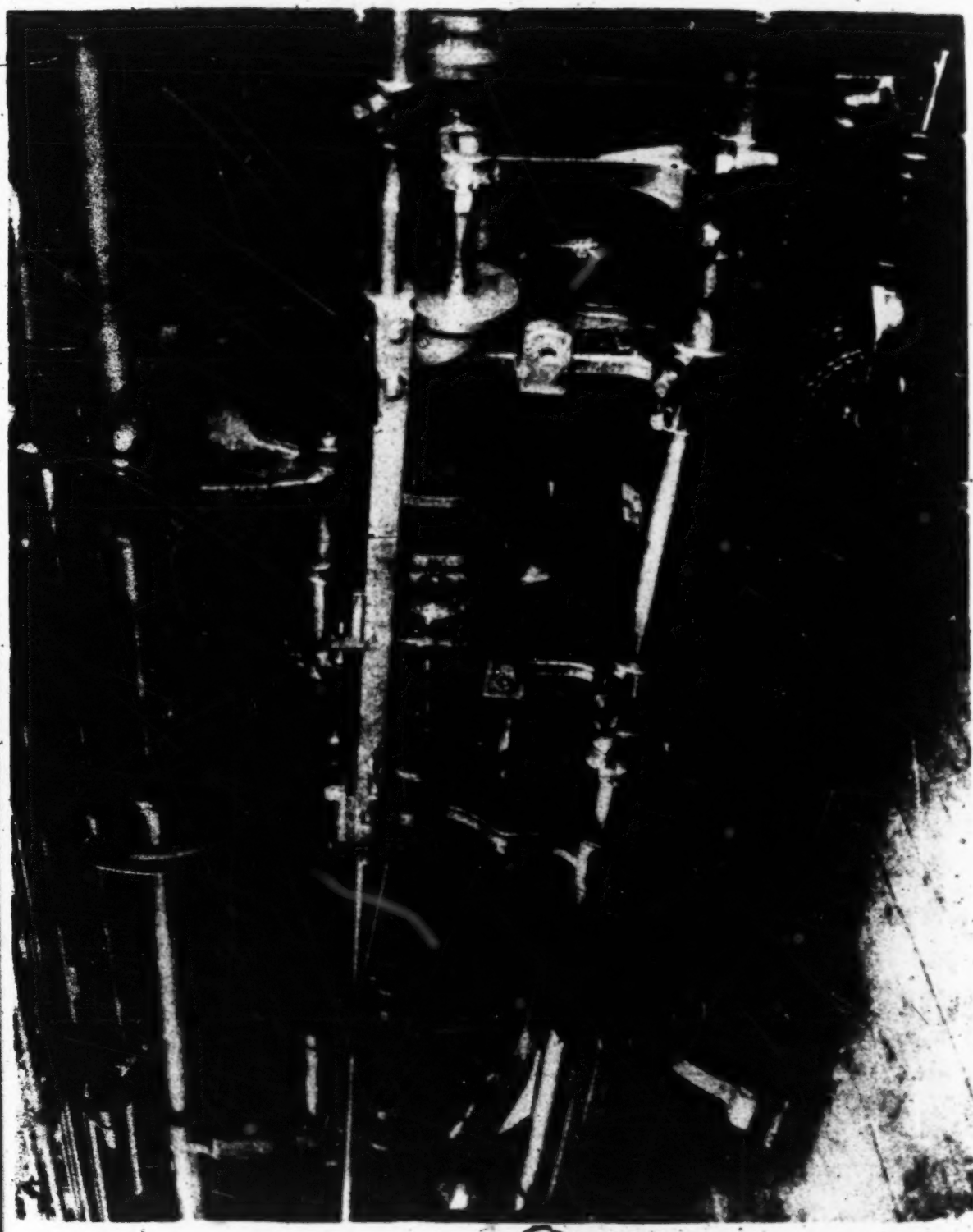
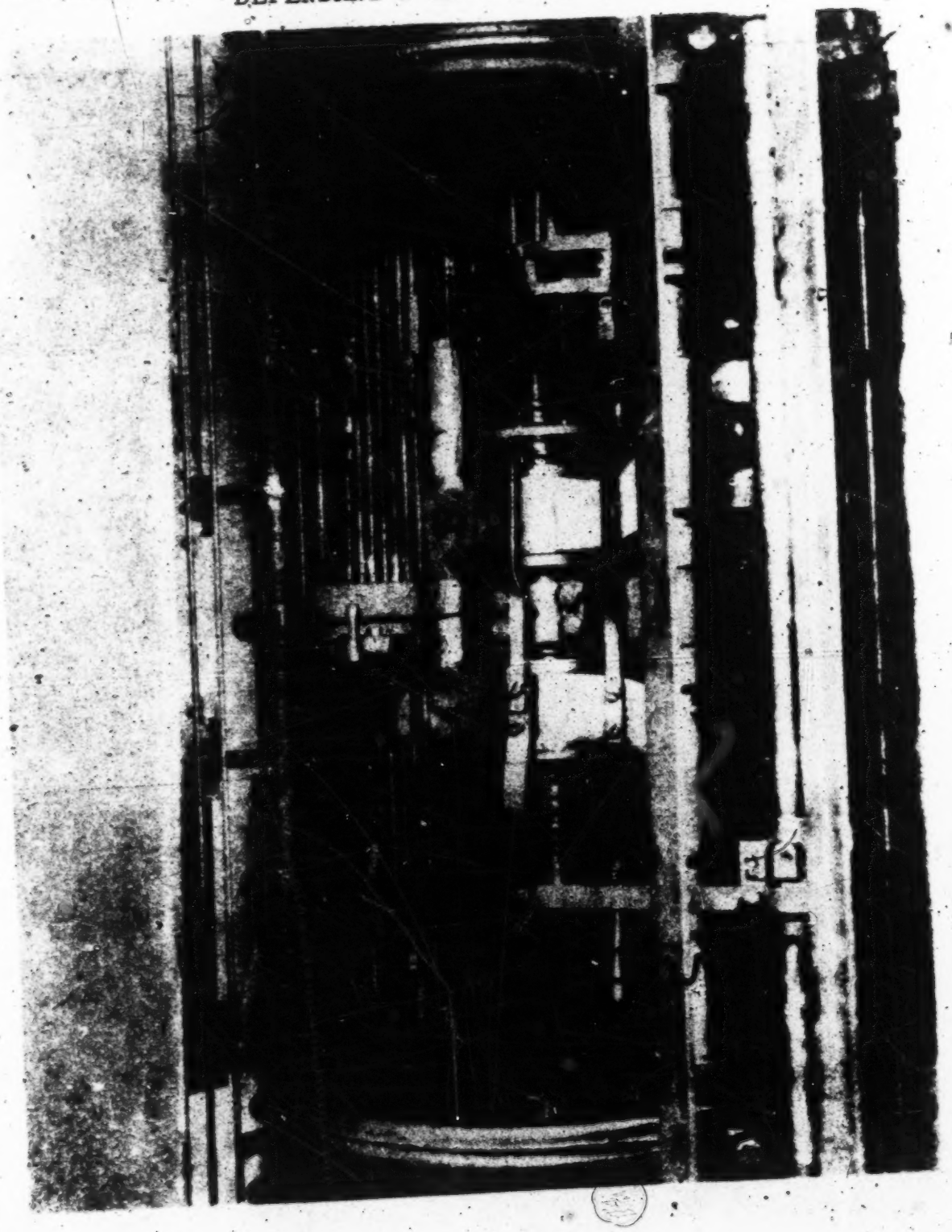
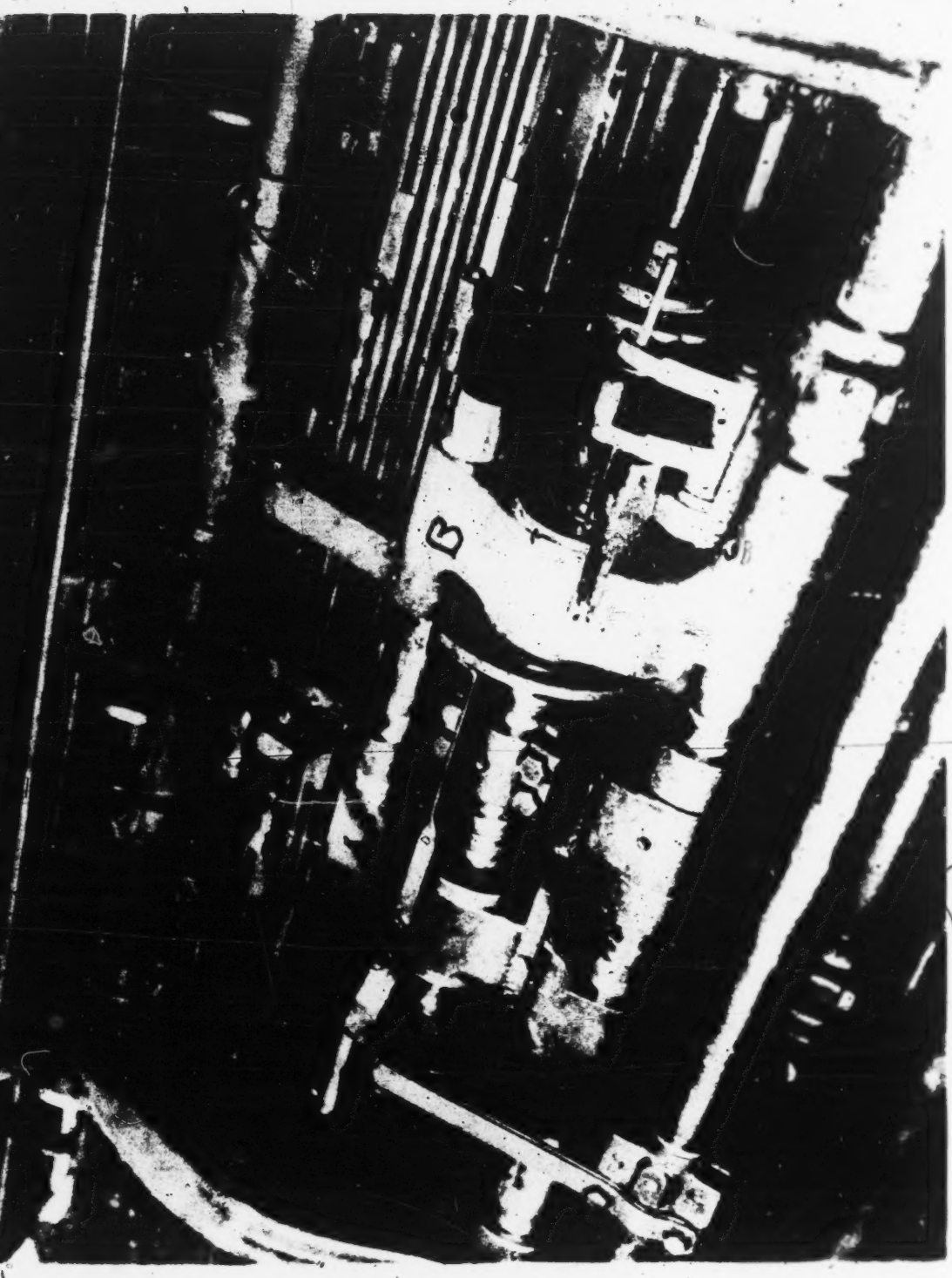


[fols. 1007-1010]

DEFENDANT'S EXHIBIT V-1



827

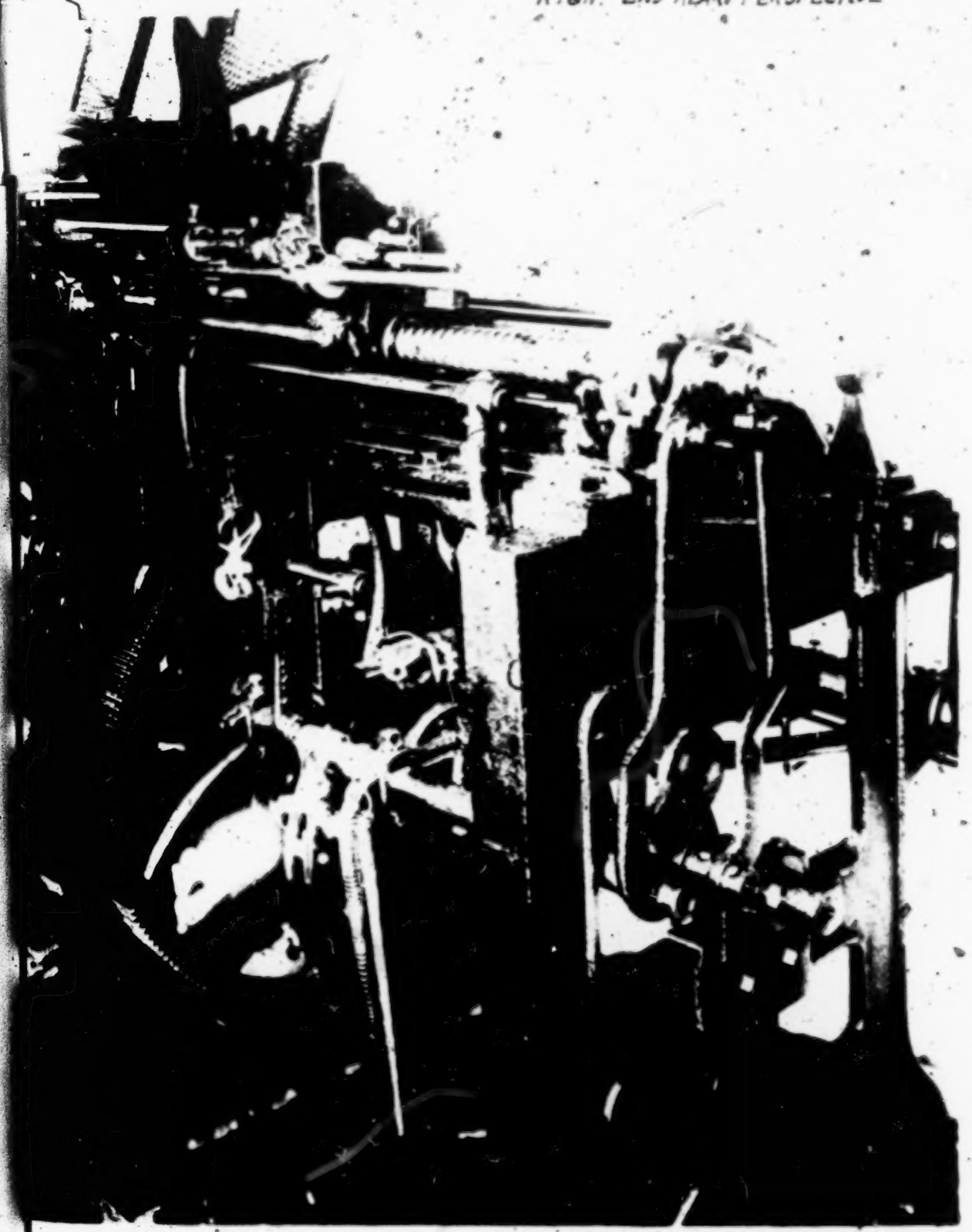

B

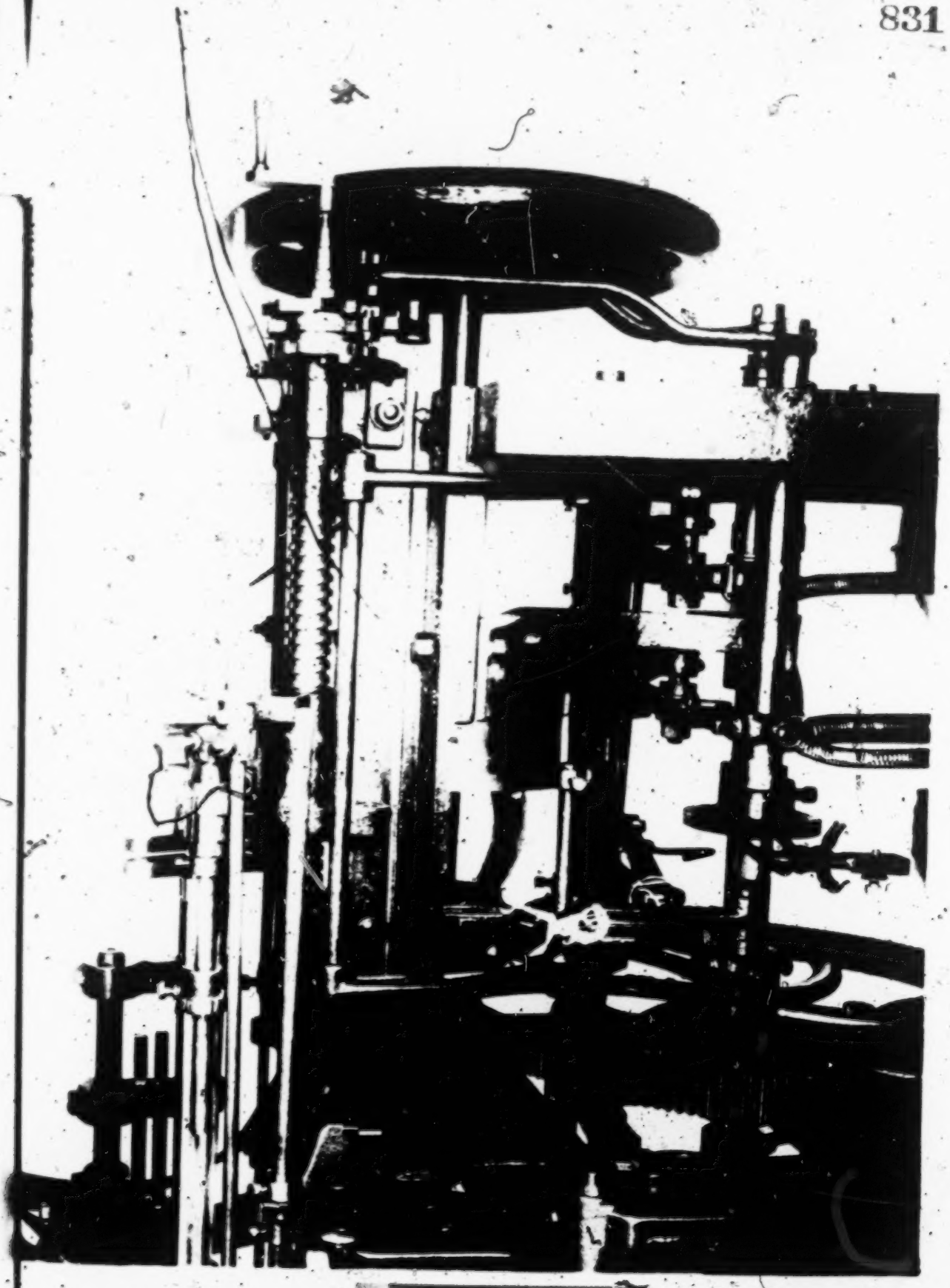
[fols. 1011-1019]

DEFENDANT'S EXHIBIT Y-1

830

RIGHT END REAR PERSPECTIVE





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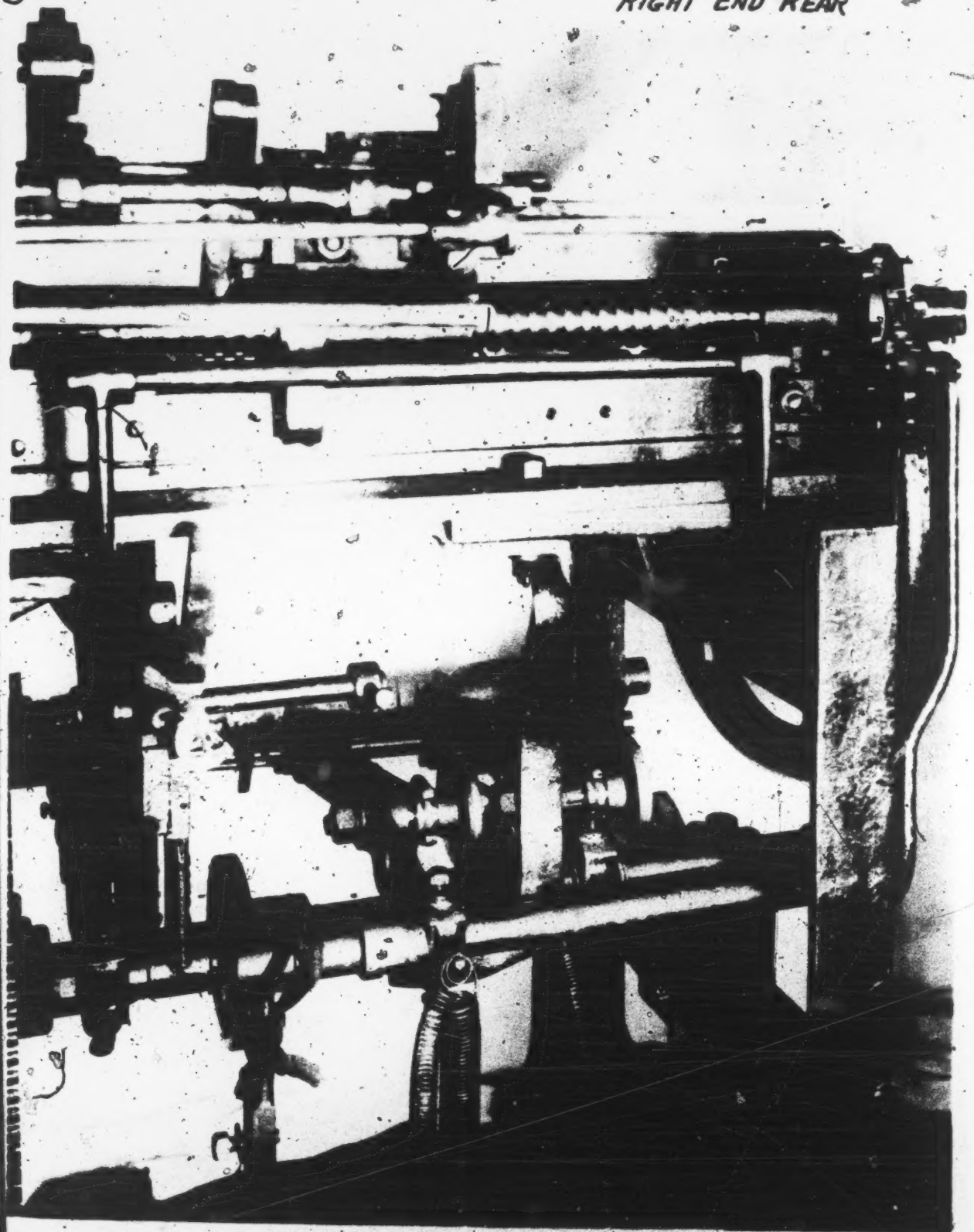
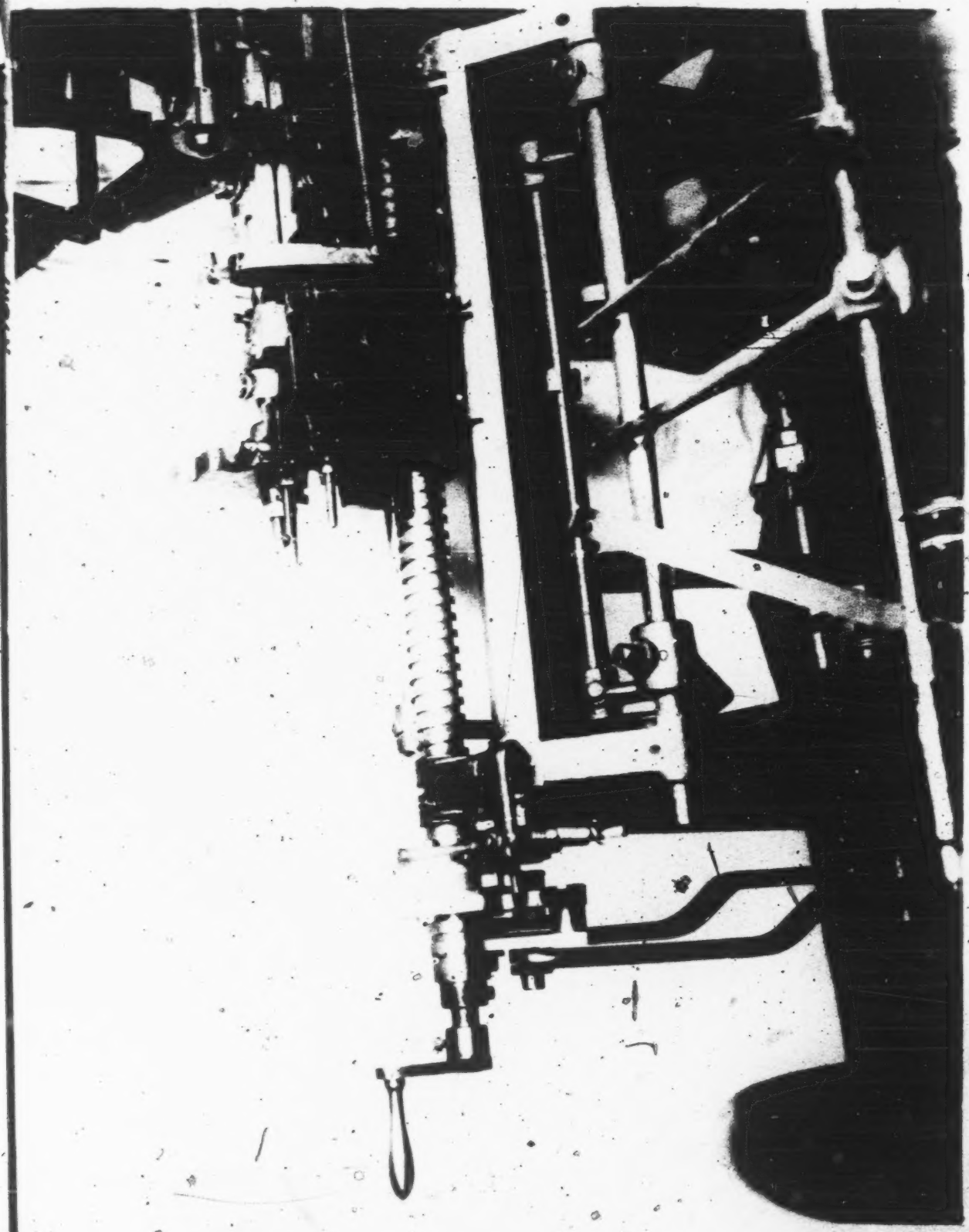
3

RIGHT END REAR





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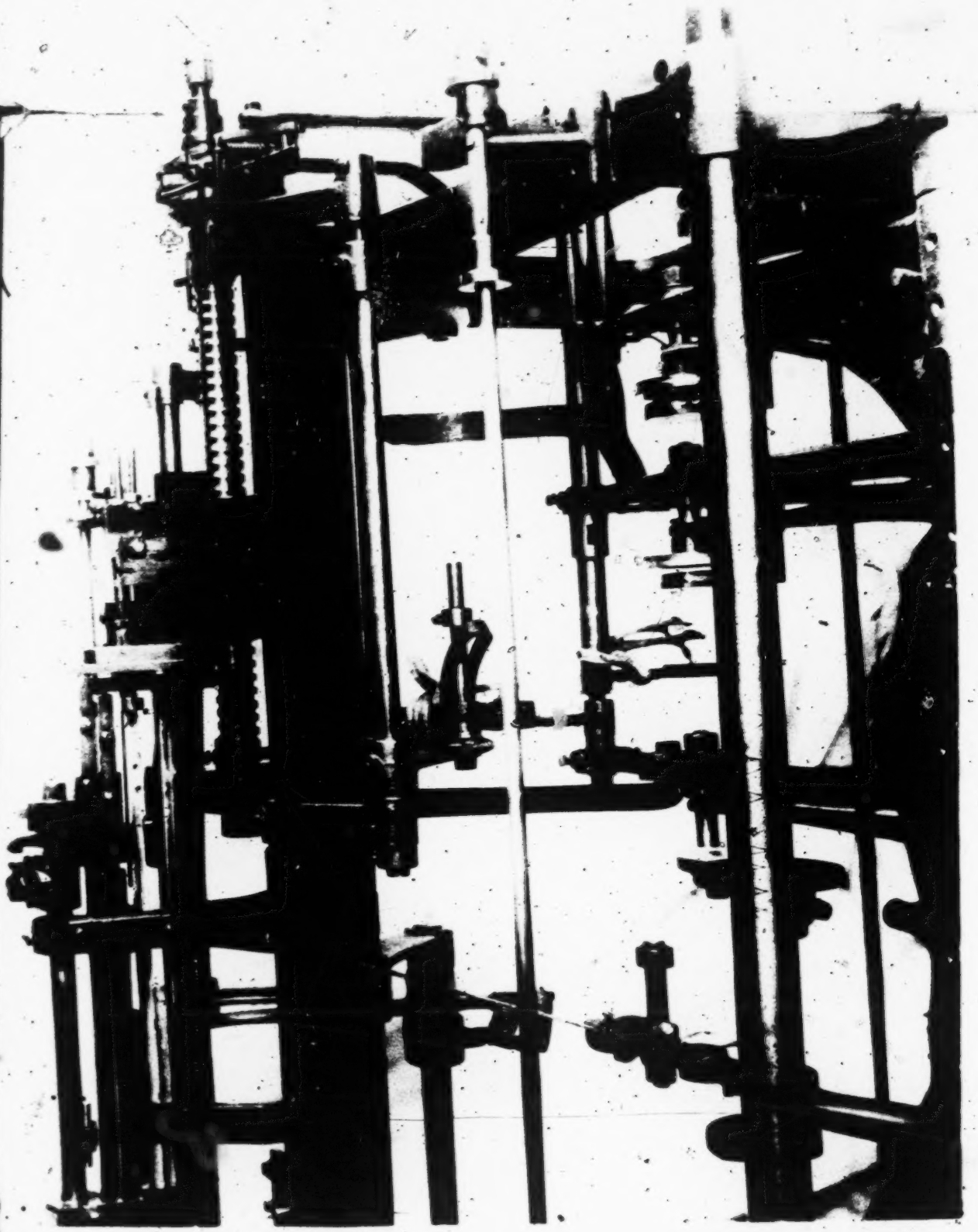
LEFT END VIEW



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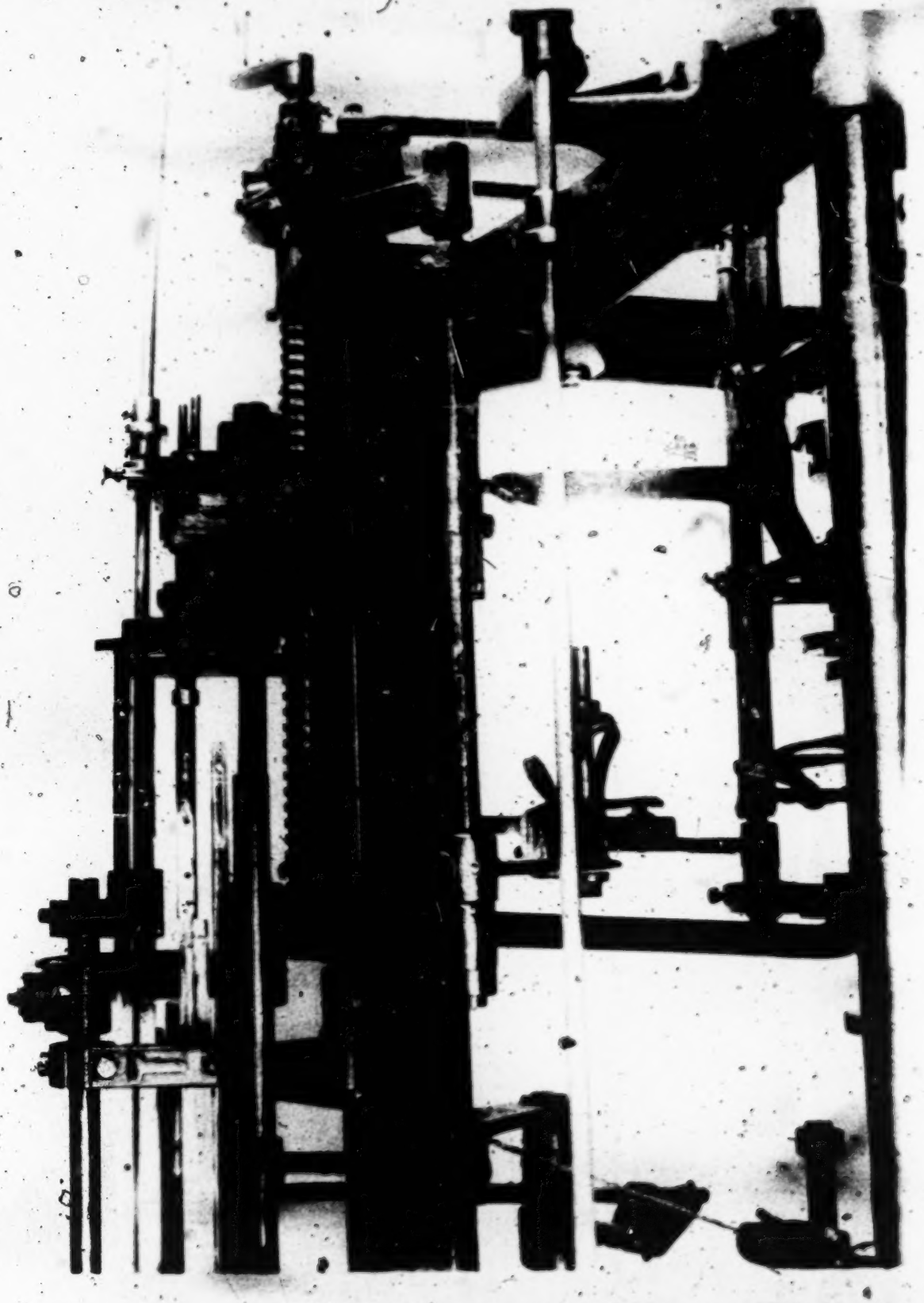

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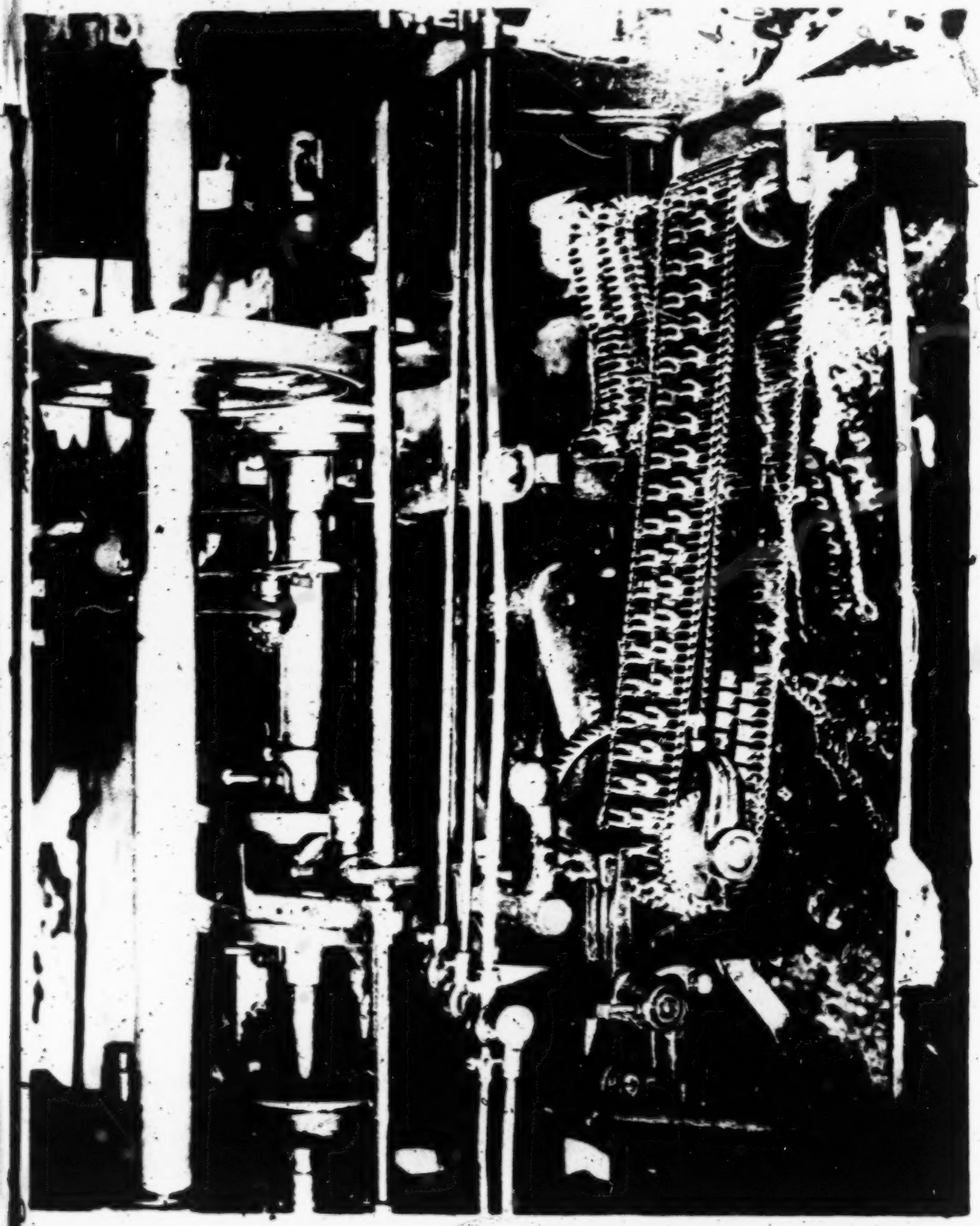

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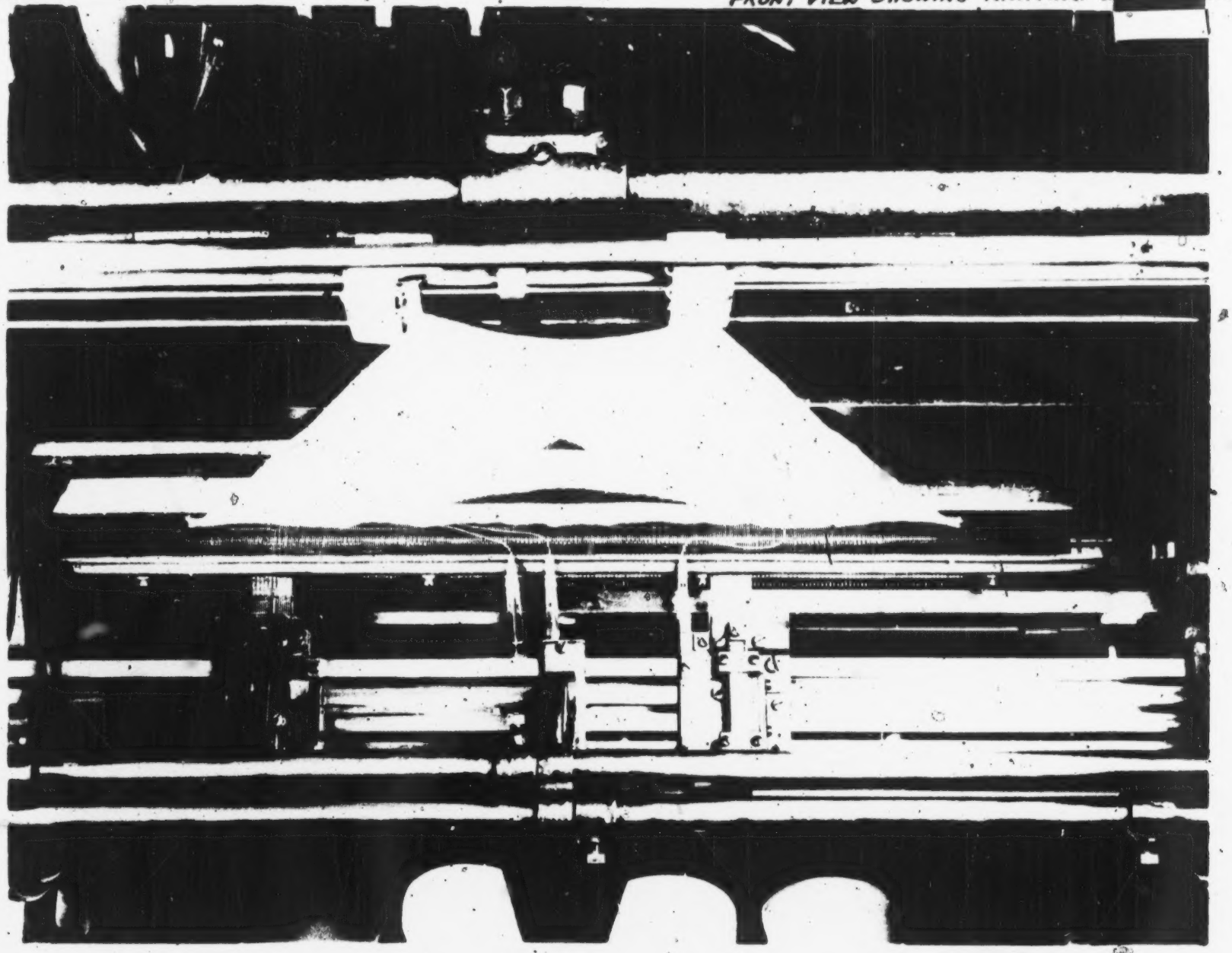
PERSPECTIVE VIEW OF FRONT OF MR

#9

#10 FRONT VIEW SHOWING KNITTING



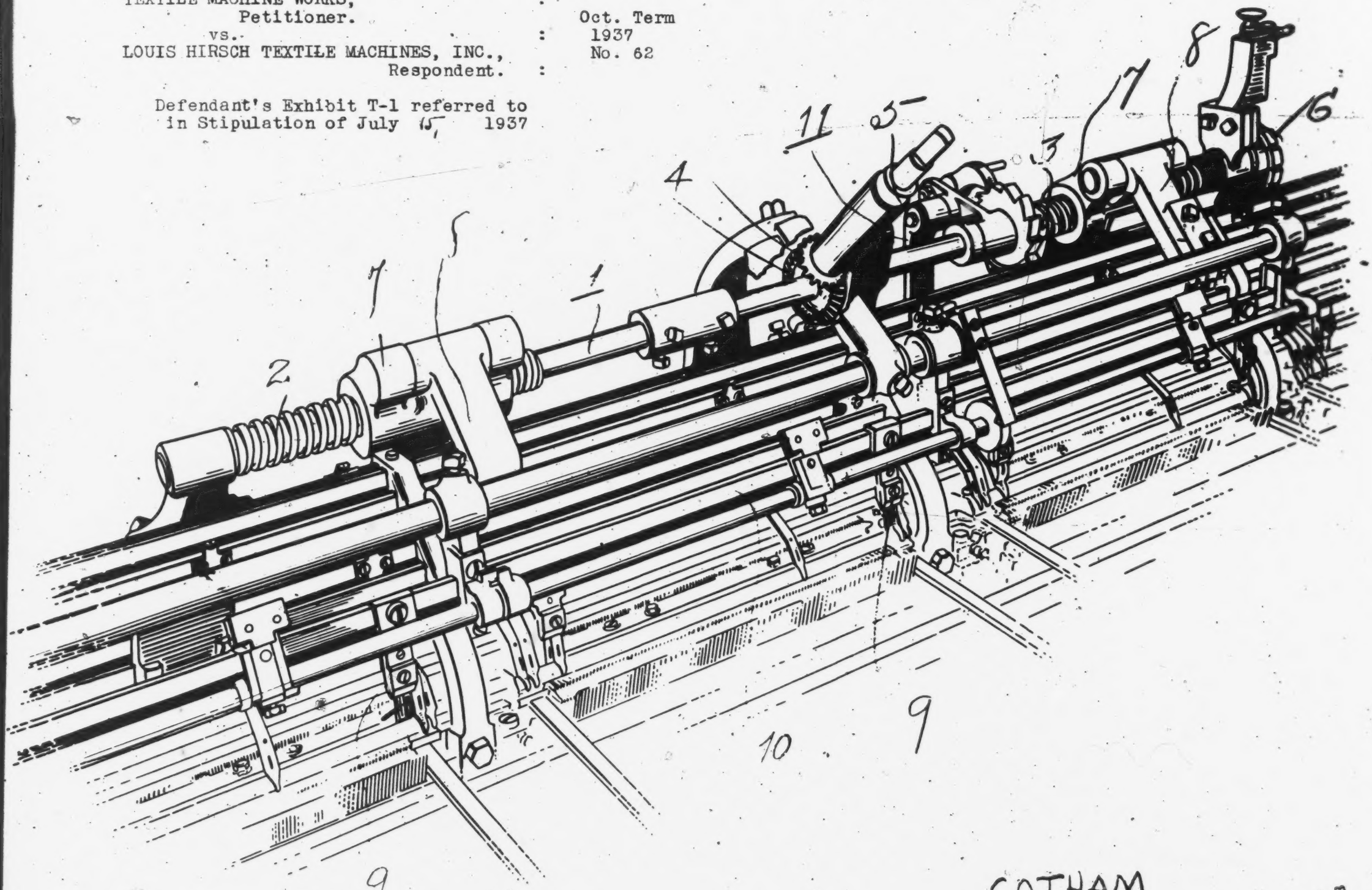
Defendants Exs B-B

IN THE SUPREME COURT OF THE UNITED STATES

TEXTILE MACHINE WORKS,
Petitioner.
vs.
LOUIS HIRSCH TEXTILE MACHINES, INC.,
Respondent.

Oct. Term
1937
No. 62

Defendant's Exhibit T-1 referred to
in Stipulation of July 15, 1937



GOTHAM

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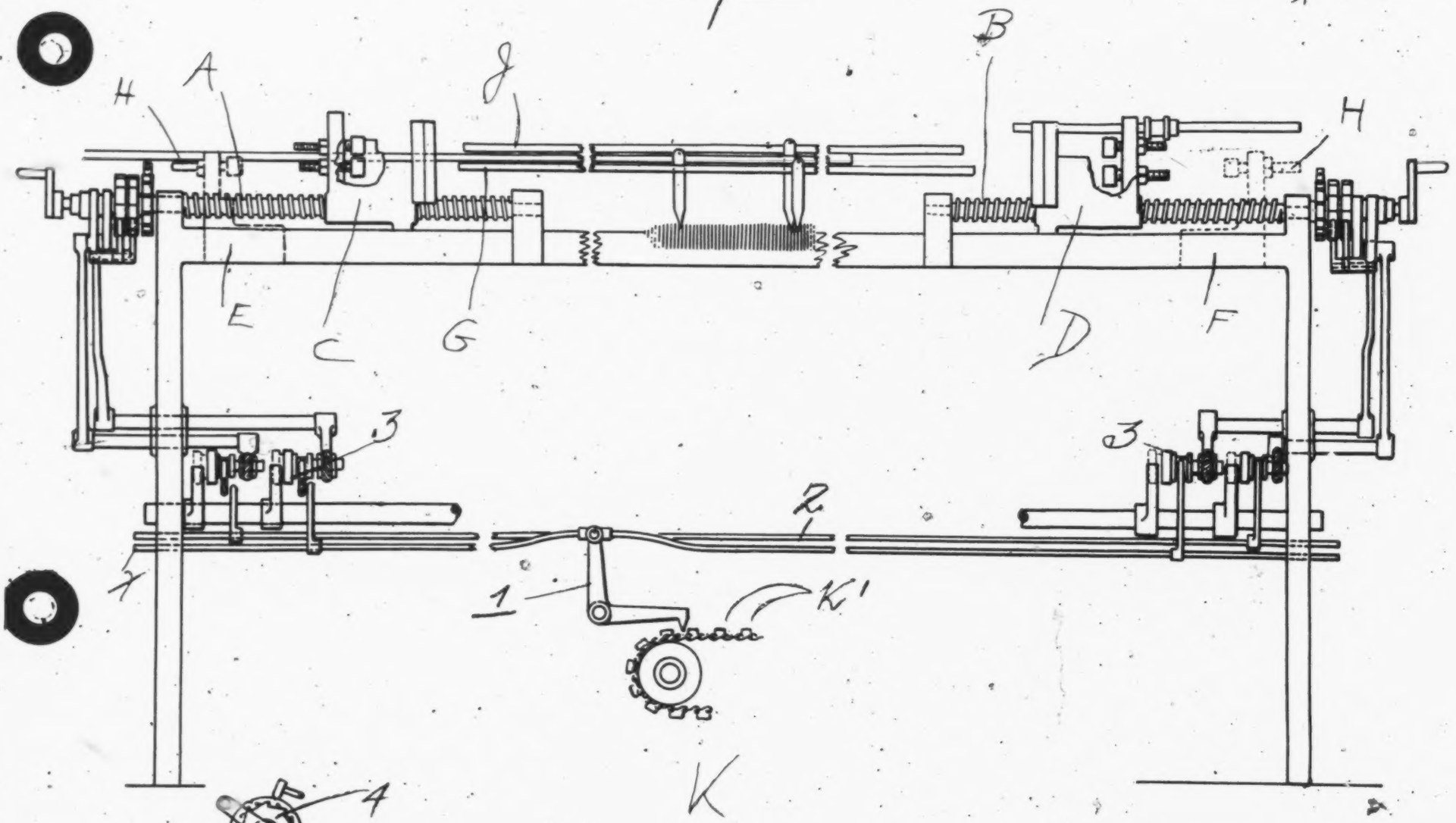
Defendants
Ex
3/2 4/3 2
C

Fig. 1



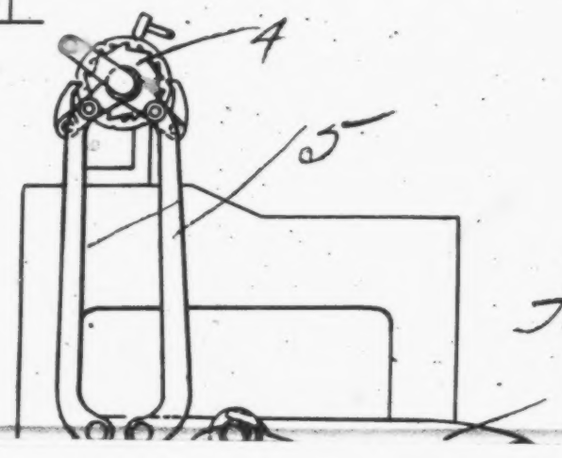


Fig 2

IN THE SUPREME COURT OF THE UNITED STATES

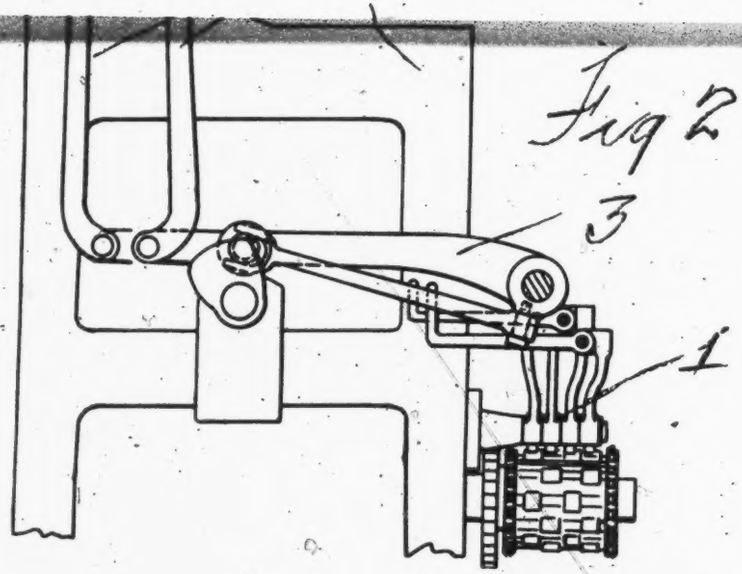
TEXTILE MACHINE WORKS, Petitioner.	:	Oct.Term
vs.	:	1937
LOUIS HIRSCH TEXTILE MACHINES, INC., Respondent.	:	No. 62

[fol. 1022] Clerk's certificate to foregoing transcript omitted in printing.

[fol. 1023] [File endorsement omitted.]

Endorsed on cover: File No. 41,533. U. S. Circuit Court of Appeals, Second Circuit. Term No. 62. Textile Machine Works, petitioner, vs. Louis Hirsch Textile Machines, Inc. Petition for a writ of certiorari and exhibit thereto. Filed May 14, 1937. Term No. 62, O. T., 1937.

(784)



IN THE SUPREME COURT OF THE UNITED STATES

TEXTILE MACHINE WORKS,
Petitioner.
vs.
LOUIS HIRSCH TEXTILE MACHINES, INC.,
Respondent.

Oct. Term
1937
No. 62

Defendant's Exhibit B-2 referred to in Stipulation of July 13, 1937.

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